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United States Patent [19]

Stephenson

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[45] Date of Patent: May 26, 1998

[54] **ELECTRONIC CAMERA AND INTEGRAL INK JET PRINTER**

[75] Inventor: **Stanley W. Stephenson**, Rochester, N.Y.

[73] Assignee: **Eastman Kodak Company**, Rochester, N.Y.

[21] Appl. No.: **767,394**

[22] Filed: **Dec. 16, 1996**

[51] **Int. Cl.**[6] **G03B 17/48**; G03B 29/00

[52] **U.S. Cl.** **347/2**; 396/374; 396/429; 358/502; 358/527; 358/906; 358/909.1

[58] **Field of Search** 396/30, 374, 429, 396/430; 358/296, 302, 401, 501, 906, 909.1, 502, 527; 347/1, 2, 108; 348/207, 373, 552, 839

[56] **References Cited**

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4,161,749	7/1979	Erlichman	358/501
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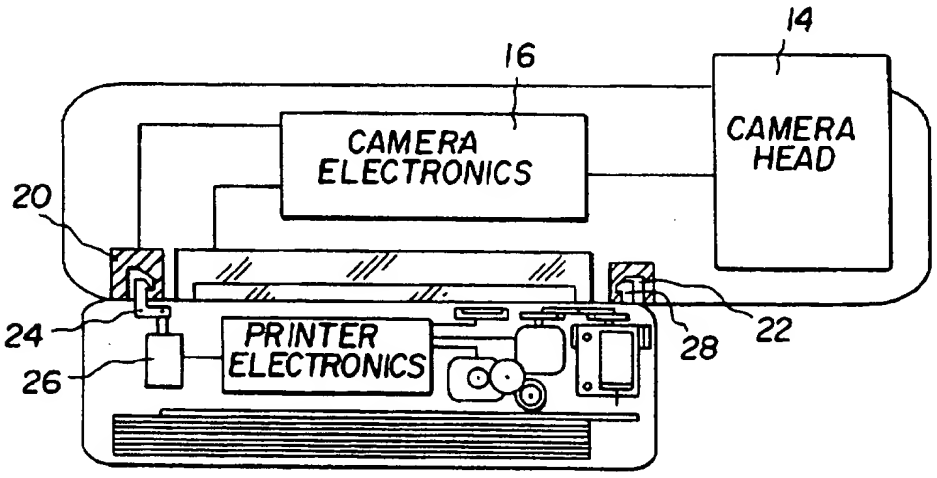
4,937,676	6/1990	Finelli et al.	358/229
5,032,911	7/1991	Takimoto	358/76
5,121,343	6/1992	Faris	347/5
5,164,751	11/1992	Weyer	396/430
5,189,522	2/1993	Stephenson, III	358/296
5,493,409	2/1996	Maeda et al.	396/429

Primary Examiner—A. A. Mathews
Attorney, Agent, or Firm—Raymond L. Owens

[57] **ABSTRACT**

Apparatus for capturing and printing images on a receiver sheet includes a camera for electronically storing an image of a subject and having a display for displaying such stored image and including alignment structure and an ink jet printer, an ink jet print head including a plurality of colored inks and a structure for providing relative movement between the ink jet print head and the receiver sheet. The ink jet print head further includes coupling the ink jet printer to the alignment structure to provide a unitary camera printer unit. Image signals are transferred to the ink jet print head to cause the ink jet print head to deliver ink to a receiver sheet to form an image corresponding to the stored image on the receiver sheet.

3 Claims, 2 Drawing Sheets



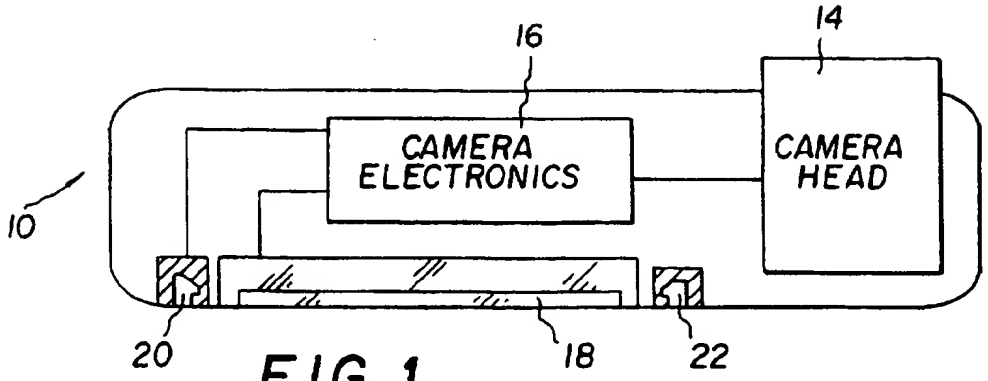


FIG. 1

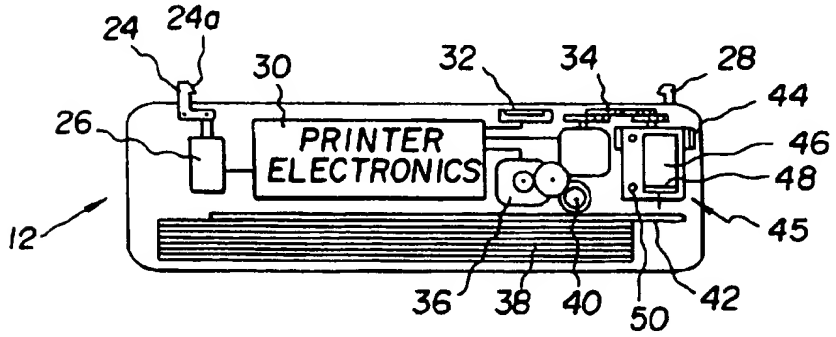


FIG. 2

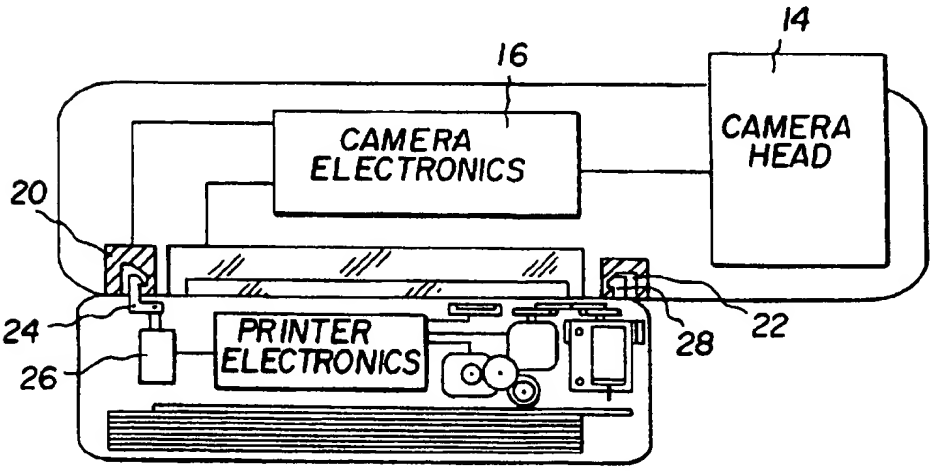


FIG. 3

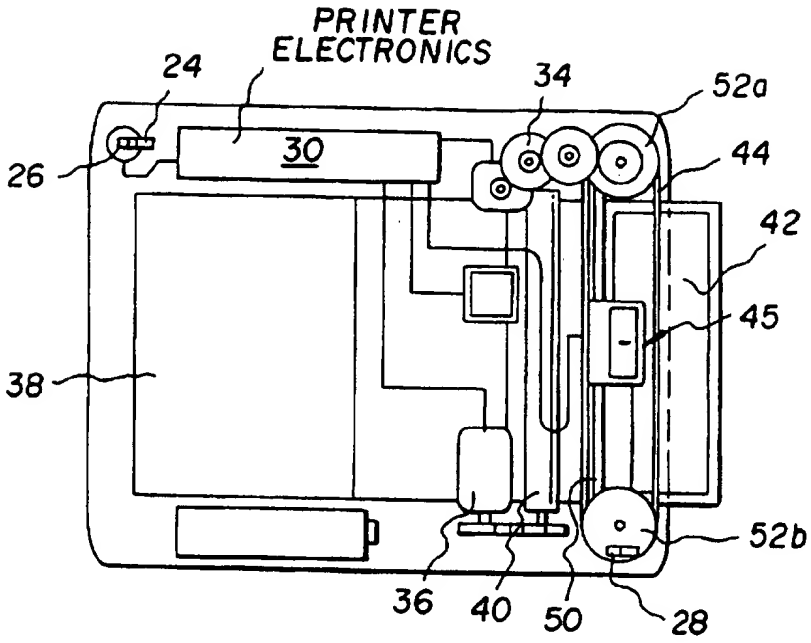

PRINTER
ELECTRONICS
24
34
52a
30
26
44
42
45
38
52b
36
40
50
28

FIG. 4

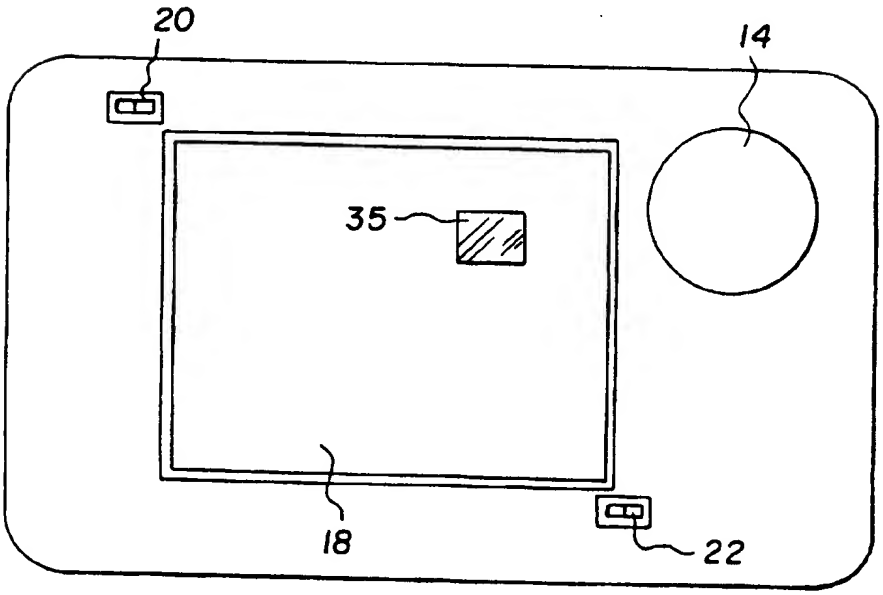

20
14
35
18
22

FIG. 5

ELECTRONIC CAMERA AND INTEGRAL INK JET PRINTER

CROSS REFERENCE TO RELATED APPLICATION

The present invention is related to U.S. patent application Ser. No. 08/767,573, filed simultaneously herewith, entitled "Electronic Camera and Associated Printer Which Uses a Display Image", assigned to the assignee of the present invention. The disclosure of these related applications is incorporated herein by reference.

1. Field of the Invention

The present invention relates to electronic cameras and to the printing of images produced by such camera.

2. Background of the Invention

It is known in the prior art to provide an electronic camera which uses an area image sensor. Digital images produced from the image sensor are stored in memory and these images can be shown on a display so that the user can determine which image should be stored for use in producing hard copy images. Typically, these images can be stored in a magnetic disk or a compact PCMCIA Flash RAM Card.

A shortcoming with prior electronic cameras is that the printer is spaced from the camera and must be electrically coupled to digital storage structure within the camera which frequently produces artifacts. Printers often use a structure which provide relative movement of a head and a media sheet which induces artifacts into the output hard copy print and is therefore difficult to provide an effective structure mounted on a camera body.

U.S. Pat. No. 4,937,676 issued Jun. 26, 1990 to Finelli et al shows an electronic imaging camera and a hard copy printer which can be interconnected for use either in combination or apart. The printer uses instant photographic film which, of course, has its own disadvantages, generally being high in speed and relatively high cost per print.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a combination of an electronic camera and a printer which can effectively provide a hard copy and minimize the above problems.

This object is achieved by apparatus for capturing and printing images on a receiver sheet comprising:

a) a camera for electronically storing an image of a subject and having a display for displaying such stored image and including alignment means;

b) an ink jet printer including means for receiving the receiver sheet, an ink jet print head including a plurality of colored inks and means for providing relative movement between the print head and the receiver sheet, such printer further including:

i) means for coupling the ink jet printer to the alignment means to provide a unitary camera printer unit; and

ii) means for transferring image signals to the print head to cause the print head to deliver ink to a receiver sheet to form an image corresponding to the stored image on the receiver sheet.

Advantages

It is an advantage of the present invention that an ink jet printer can be integrally coupled to an electronic camera improving the electronic interconnection between the camera and the printer and providing high quality, low cost prints. Moreover, by coupling the ink jet printer and the camera, a portable assembly is provided.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a top section view of an electronic camera which is adapted to be coupled to an ink jet printer in accordance with the present invention;

FIG. 2 is a top section view of the ink jet printer which is adapted to be coupled to the electronic camera of FIG. 1;

FIG. 3 shows the ink jet printer of FIG. 2 attached to the camera of FIG. 1;

FIG. 4 is a front sectional view showing portions of the ink jet printer of FIG. 2; and

FIG. 5 is a rear view of the electronic camera shown in FIG. 1.

DETAILED DESCRIPTION OF THE INVENTION

The invention is directed to a compact ink jet printer used in conjunction with electronic cameras. Such cameras often have a flat panel color display that is used to frame and/or review capture images. Separable printers exist that receive data from said electronic capture devices. Typically, interface electronics is disposed in each device and data is transmitted from the electronic camera to the printer.

Turning now to FIGS. 1, an electronic camera **10** is shown and in FIG. 2 an ink jet printer **12** is shown. Electronic camera **10** is of conventional design and can capture either still or motion images. Images are captured by camera head **14** which typically includes an optical system and an image sensor. Electronic signals from the camera head **14** are transferred to camera electronics **16**. Camera electronics **16** includes a storage memory for storing digital images captured by the image sensor. These stored images are used to drive the camera display **18** in a well known manner. Camera display **18** can be for instance a LCD or organic polymer display system of conventional design.

Electronic camera **10**, in accordance with the present invention, includes the additional modification of an active socket **20** and a passive socket **22** for the purpose of connecting the ink jet printer **12** over camera display **18** to form a unitary camera printer unit. By unitary camera printer unit is meant that the two units can be coupled to provide a portable assembly. Moreover, the printer can make copies when it is directly coupled to the camera. Active socket **20** incorporates electronic sensing circuitry to communicate with ink jet printer **12**.

Electronic sensing circuitry can be a wire active socket **20** to communicate with ink jet printer **12**. Alternatively, a light sensing/transmitting assembly can be incorporated in or near the active socket **20**.

The ink jet printer **12** has an active latch **24** and a passive latch **28** that permits the printer to be secured over the camera display **18**. In this embodiment the latches **24** and **28** are hooked and secure to matching detail **24***a* formed in the sockets **20** and **22** of camera **10**. The rear view of the camera in FIG. 5 shows the position of the active socket **20** and the passive socket **22** and camera display **18**. A latch driver **26** permits the selective securing and release of the ink jet printer **12** from camera **10** under control of printer electronics **30**. FIG. 3 shows the ink jet printer **12** secured to camera **10**.

The ink jet printer **12** contains a stack of media sheets **38**. A roller **40**, disposed over the stack, is actuated to advance a printable sheet **42** from media sheets **38** past an ink jet print

head **45**. The print head will be understood to include a plurality of colored inks so that it is capable of reducing esthetically pleasing colored images with relatively high resolution. In one embodiment, the ink jet print head **45** contains an ink reservoir **46** that supplies ink to an ink jet **48**. FIG. **4** shows a top view of the printer. A set of pulleys **52***a* and **52***b*, secure a drive belt **44** that is attached to the ink jet print head **45**. Guide rails **50** are used to guide the ink jet print head **45** transverse to the direction of motion of the printable sheet **42**.

It is an important feature of the present invention that when the ink jet printer **12** is attached to the camera **10**, prints can be made when it is part of the unitary camera printer unit. Alternatively, the ink jet printer **12** can be decoupled from the camera and can be used as a spaced apart accessory, typically connected by wiring to the camera **10**. A colored image is formed on printable sheet **42** by advancing printable sheet **42** an incremental amount using roller **40** and roller drive **36**. Head drive **34** is actuated to drive the ink jet print head **45** longitudinally across printable sheet **42**. The ink jet print head **45** is selectively driven by printer electronics **30** so as to form a strip of printed image. The printer electronics **30** can conveniently receive image information from the camera electronics **16** which includes a storage unit as previously discussed. However, in accordance with the present invention, the printer electronics **30** can also be directly coupled to the camera display **18** using printer receiver device **32**, discussed hereinafter. After the ink jet print head **45** has completed a section of the image, printable sheet **42** is advanced again to begin the next printing cycle. The process is continued until a complete image is formed on printable sheet **42**.

Image transfer between electronic camera **10** and ink jet printer **12** is accomplished using image display **18** in conjunction with a printer receiver device **32** which is sensitive to emissions from camera display **18**. Printer receiver device **32** can be a sparse array of charged couple device elements of conventional design. Alternatively, printer receiver device **32** can be one or more photosensitive semiconductor devices responsive to light emitted from camera display **18**.

In operation, an operator obtains a print by interconnecting ink jet printer **12** with the camera **10**. Latches **24** and **28** automatically secure ink jet printer **12** to electronic camera **10**. The operator signals the start of printing using printer electronics **30**. The printer's active socket **20** signals the camera electronics **16** to indicate that it is in the condition for transferring images to the ink jet printer **12** using camera display **18**. Upon print initialization, electronic camera **10** selectively modulates camera display **18** so as to communicate with printer receiver device **32**. The printer electronics **30** and the camera electronics **16** are designed to optimize data transmission.

The printer receiver device **32** includes of a 10 by 10 array of sensing sites. Each site covers a 10 by 10 array of pixels on the camera display. The 100 sets of 100 pixels are modulated to transmit image data in parallel. A limited number of 16 density levels can be used across the set of camera pixels to increase data transmission rates. Using this method 400 bits of data can be transmitted per camera display **18** update. Display area **35** corresponds to the area sensed by printer receiver device **32**. Display area **35** and printer receiver sensor **32** are kept in close alignment by the camera sockets and the printer latches.

It is advantageous for the camera **10** and the ink jet printer **12** to indicate the change in camera display **18** from a display to a data transmission mode. This is accomplished by a sensor on the camera detecting printer presence. Timing signals transmitted through active socket **20** and active latch **24** are used to synchronize display modulation and the printer data reception. Active latch **24** is used to signal start of transmission. Transmission can be synchronized by embedding timing signals into the camera display signal.

Data transmission is done synchronous with the printing of the image per U.S. Pat. No. 5,189,522, the disclosure of this patent is incorporated by reference. Alternatively all or a large subset of the image can by transferred to memory elements in printer electronics **30** prior to the beginning of dye deposition.

The use of the latch driver **26** under the control of printer electronics **30** ensures that ink jet printer **12** is not detached from electronic camera **10** during image transmission from camera display **18** and printer receiver device **32**. An operator detaches ink jet printer **12** from electronic camera **10** using an interface to printer electronics **30** such as a conventional switch. Printer electronics **30** then activates latch driver **26** to permit removal of ink jet printer **12** from camera **10**.

The invention has been described in detail with particular reference to a certain preferred embodiment thereof, but it will be understood that variations and modifications can be effected within the spirit and scope of the invention.

Parts List

10 electronic camera
12 ink jet printer
14 camera head
16 camera electronics
18 camera display
20 active socket
22 passive socket
24 active latch
24*a* detail
26 latch driver
28 passive latch
30 printer electronics
32 printer receiver device
34 head drive
35 display area
36 roller drive
38 media sheets
40 roller
42 printable sheet
44 drive belt
45 ink jet print head
46 ink reservoir
48 ink jet
50 guide rails
52*a* pulley
52*b* pulley

We claim:

1. Apparatus for capturing and printing images on a receiver sheet comprising:

a) a camera for electronically storing an image of a subject and having a display effective in a first condition for displaying such stored image and effective in a second condition for permitting image transfer and including alignment means;

b) an ink jet printer including means for receiving the receiver sheet, an ink jet print head including a plurality of colored inks and means for providing relative movement between the print head and the receiver sheet, such ink jet printer further including:

i) means for coupling the ink jet printer to the alignment means to provide a unitary camera printer unit;

iii) means for transferring image signals to the ink jet print head to cause the ink jet print head to deliver ink to a receiver sheet to form an image corresponding to the stored image on the receiver sheet; and

wherein the alignment means further includes an active socket which includes electronic sensing circuitry for communicating with the ink jet printer.

2. The apparatus of claim 1 further including means for preventing the ink jet printer from being detached from the camera when there is electronic communication between the display and the ink jet print head.

3. Apparatus for capturing and printing images on a receiver sheet comprising:

(a) a camera for electronically storing an image of a subject and having a display for displaying such stored image and including alignment means;

(b) a printer including means for receiving the receiver sheet, a print head and means for providing relative movement between the print head and the receiver sheet, such printer further including:

(i) means for coupling the printer to the alignment means to provide a unitary camera printer unit;

(ii) means for providing electronic communication between the display and the print head to transfer image to the print head;

(iii) means for causing the print head to form an image of the stored image on the receiver sheet;

wherein the alignment means further includes an active socket which includes electronic sensing circuitry for communicating with the printer; and

further including means for preventing the printer unit from being detached from the camera when there is electronic communication between the display and the print head.

* * * * *

US005708821A

United States Patent [19]

Takikita

[11] Patent Number: 5,708,821

[45] Date of Patent: Jan. 13, 1998

[54] **PRINTING APPARATUS AND METHOD OF SAVING POWER OF THE SAME**

[75] Inventor: **Hiromichi Takikita**, Shizuoka, Japan

[73] Assignee: **Star Micronics Co., Ltd.**, Shizuoka, Japan

[21] Appl. No.: **578,434**

[22] Filed: **Dec. 26, 1995**

[30] **Foreign Application Priority Data**

Jan. 17, 1995 [JP] Japan 7-005052

[51] **Int. Cl.**[6] **G06F 1/26**; G06F 1/32

[52] **U.S. Cl.** **395/750**; 395/113

[58] **Field of Search** 395/106, 113, 395/114, 750; 364/707; 347/211; 399/70

[56] **References Cited**

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4,991,114	2/1991	Kawamura et al.	395/114
5,018,079	5/1991	Shukunami et al.	395/106
5,321,428	6/1994	Dornier	346/76
5,483,464	1/1996	Song	364/492
5,493,684	2/1996	Gephardt et al.	395/750
5,521,686	5/1996	Muto	355/285
5,568,594	10/1996	Suzuki	395/112

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57-155633 9/1982 Japan .

Primary Examiner—Gopal C. Ray

Attorney, Agent, or Firm—Wenderoth, Lind & Ponack

[57] **ABSTRACT**

A printing apparatus comprises a main control circuit **1**, an image forming section **10**, an interface **8** for communicating with an external host system **9**, and an operation panel **20** including operating switches. The apparatus further comprises power cutoff circuits **32** and **33** for interrupting a power supply to the image forming section **10** in response to a command from the main control circuit **1**. In the case where a signal input is applied from the operation panel **20** for designating the power saving mode while the printing data is being transmitted from the external host system **9**, the transmission data from the external host system **9** are all received and discharged. The power saving mode is started after discharging the data. An erroneous operation can thus be prevented in starting or canceling the power saving mode.

10 Claims, 4 Drawing Sheets

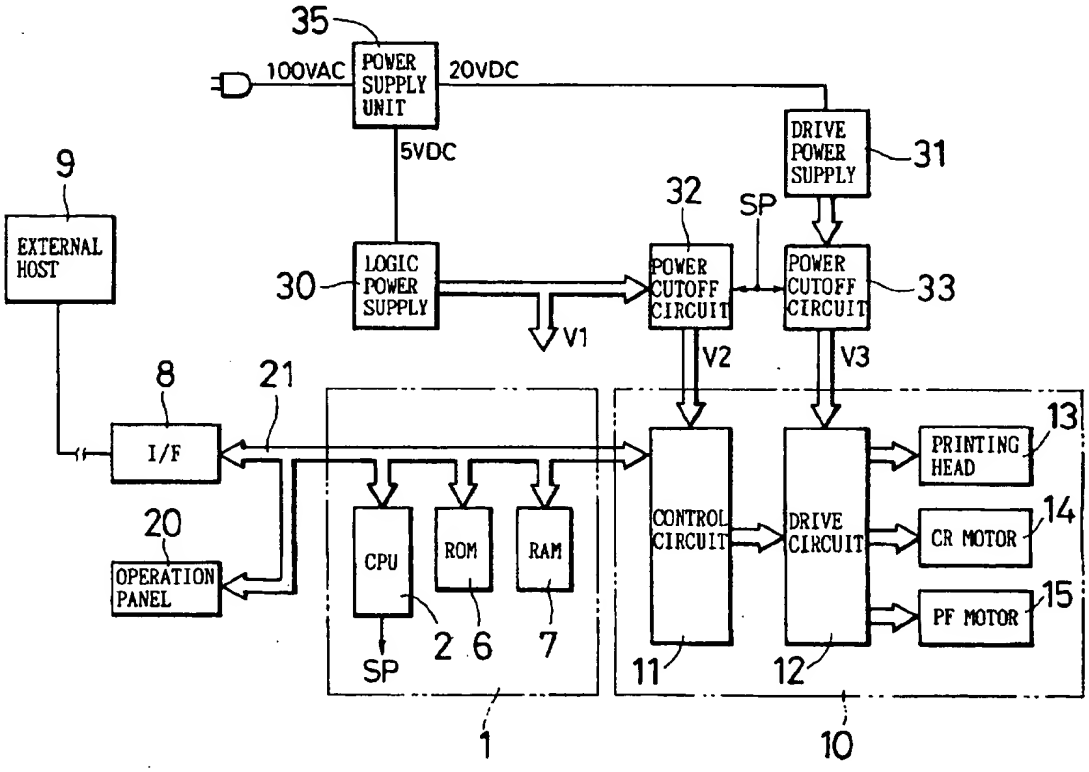


FIG. 1

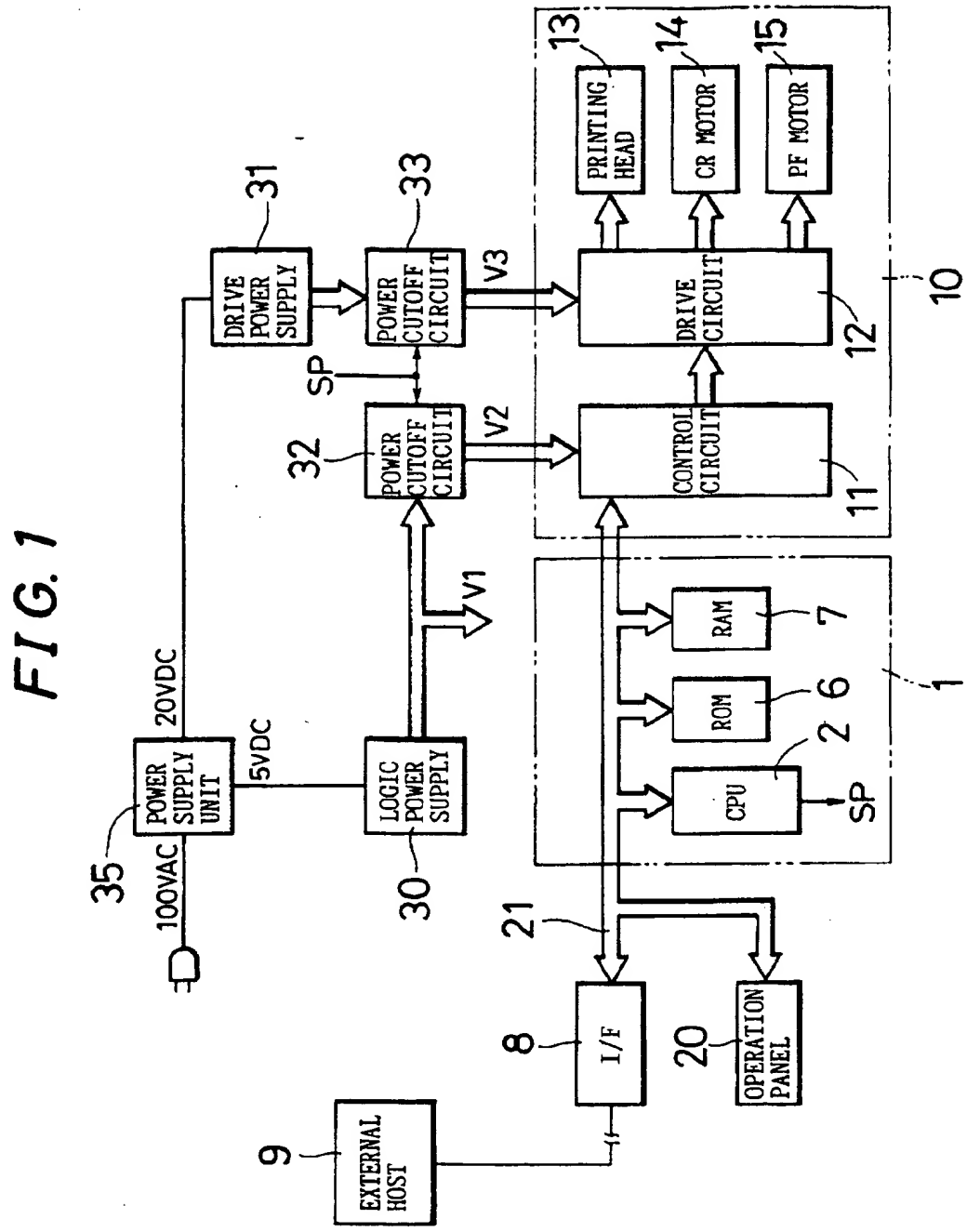

13
14
15
PRINTING HEAD
CR MOTOR
PF MOTOR
31
33
DRIVE POWER SUPPLY
POWER CUTOFF CIRCUIT
V3
DRIVE CIRCUIT
10
12
SP
32
POWER CUTOFF CIRCUIT
V2
CONTROL CIRCUIT
11
V1
RAM
7
ROM
6
2
CPU
SP
1
20VDC
5VDC
POWER SUPPLY UNIT
LOGIC POWER SUPPLY
35
100VAC
30
21
8
I/F
20
OPERATION PANEL
9
EXTERNAL HOST

FIG. 2

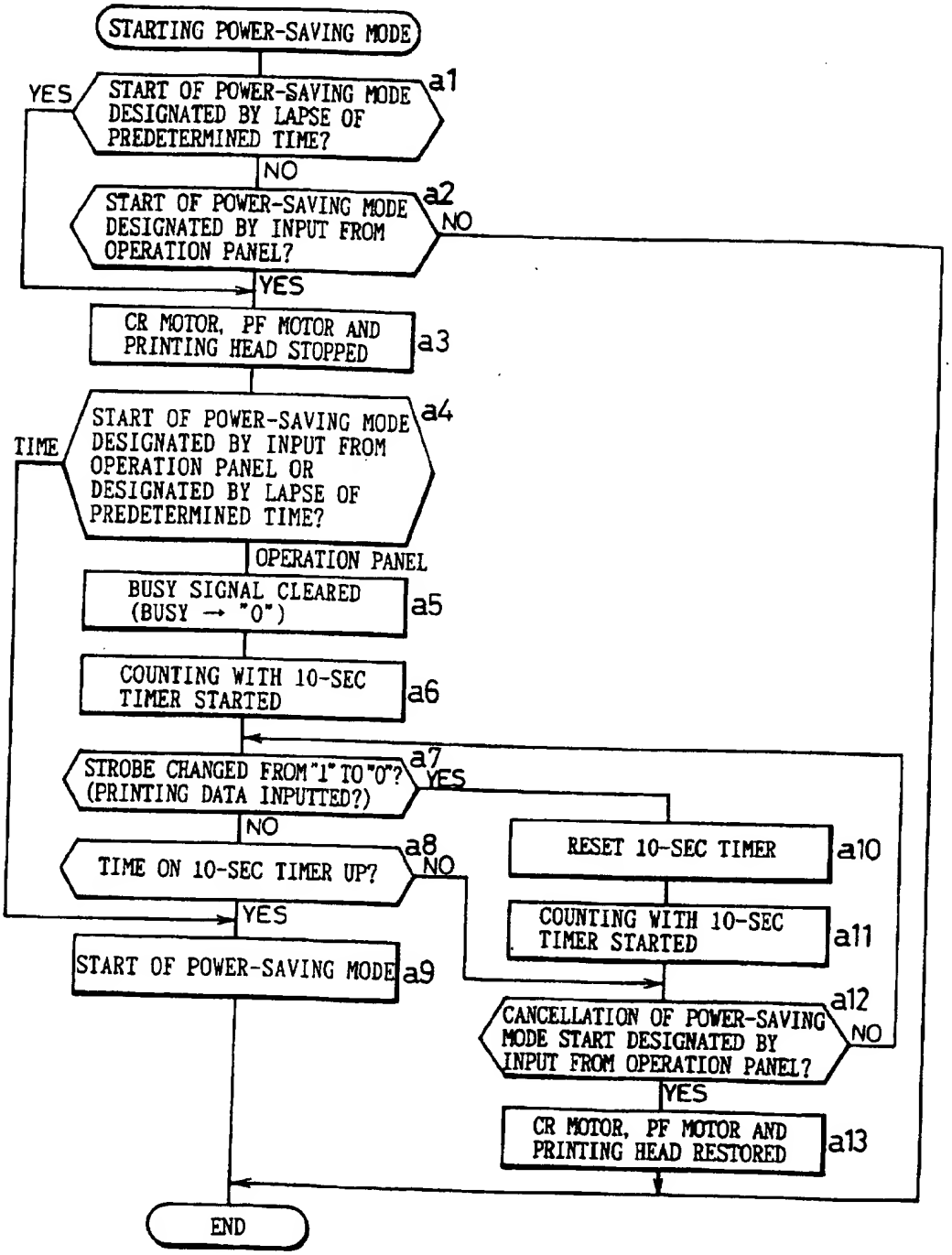

STARTING POWER-SAVING MODE
YES
START OF POWER-SAVING MODE DESIGNATED BY LAPSE OF PREDETERMINED TIME?
a1
NO
START OF POWER-SAVING MODE DESIGNATED BY INPUT FROM OPERATION PANEL?
a2
NO
YES
CR MOTOR, PF MOTOR AND PRINTING HEAD STOPPED
a3
TIME
START OF POWER-SAVING MODE DESIGNATED BY INPUT FROM OPERATION PANEL OR DESIGNATED BY LAPSE OF PREDETERMINED TIME?
a4
OPERATION PANEL
BUSY SIGNAL CLEARED (BUSY → "0")
a5
COUNTING WITH 10-SEC TIMER STARTED
a6
STROBE CHANGED FROM "1" TO "0"? (PRINTING DATA INPUTTED?)
a7
YES
NO
TIME ON 10-SEC TIMER UP?
a8
NO
YES
START OF POWER-SAVING MODE
a9
RESET 10-SEC TIMER
a10
COUNTING WITH 10-SEC TIMER STARTED
a11
CANCELLATION OF POWER-SAVING MODE START DESIGNATED BY INPUT FROM OPERATION PANEL?
a12
NO
YES
CR MOTOR, PF MOTOR AND PRINTING HEAD RESTORED
a13
END

FIG. 3

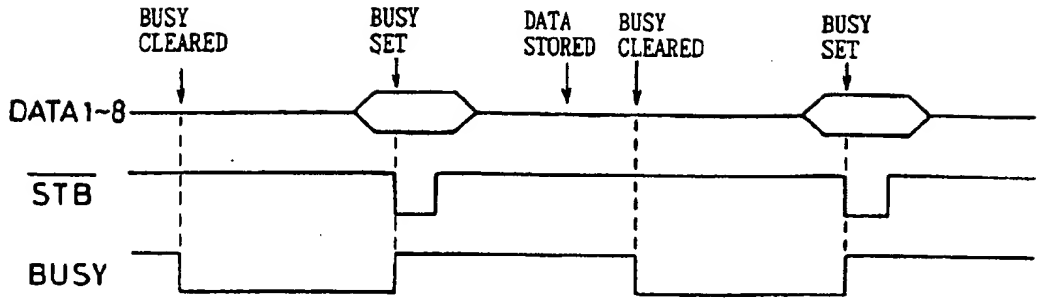

BUSY CLEARED
BUSY SET
DATA STORED
BUSY CLEARED
BUSY SET
DATA 1~8
STB
BUSY

FIG. 4

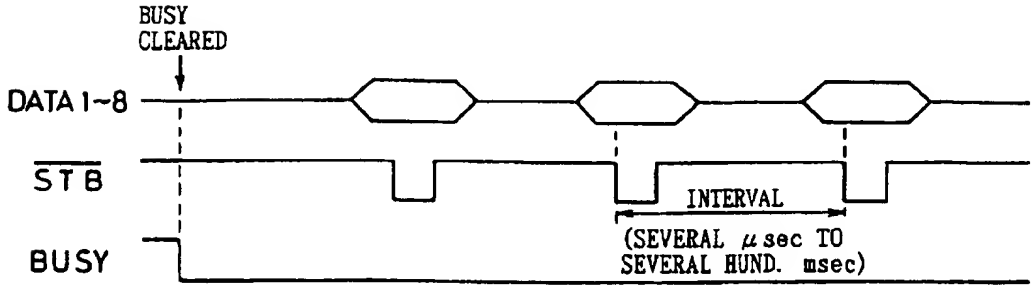

BUSY CLEARED
DATA 1~8
STB
INTERVAL
(SEVERAL μsec TO SEVERAL HUND. msec)
BUSY

FIG. 5A
PRIOR ART

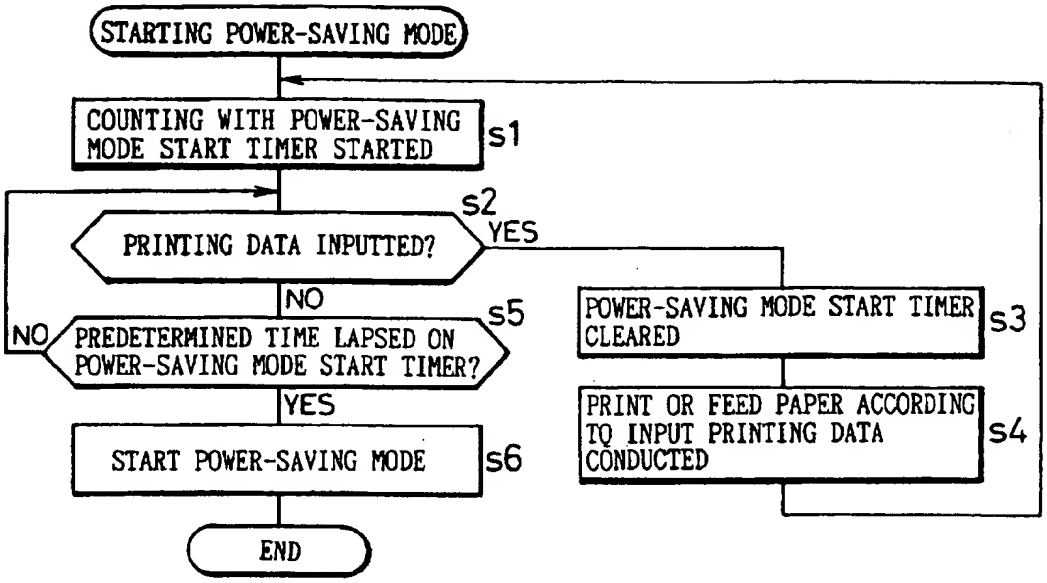
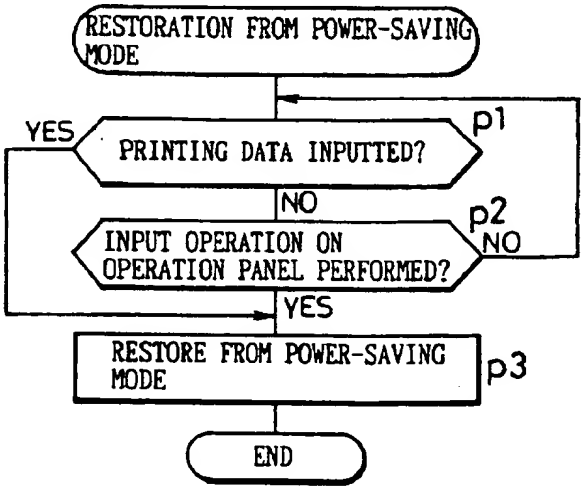


FIG. 5B
PRIOR ART



PRINTING APPARATUS AND METHOD OF SAVING POWER OF THE SAME

BACKGROUND OF THE INVENTION

1. Technical Field of the Invention

The present invention relates to a printing apparatus for forming characters and images on a recording medium, more particularly to a printing apparatus capable of reducing the power consumption in the out-of-operation state and a method of reducing the power consumption.

2. Description of Related Art

Conventional printing apparatuses, such as a serial dot printer, have such a configuration in general that the electric power supplied to the whole apparatus is controlled by a single power switch, i.e., power supply to the whole apparatus is started by turning on a first power switch and stopped by turning off the first power switch.

In recent years, in order to reduce the power consumption, there has been proposed a printing apparatus comprising a second power switch for controlling the power supply to specific parts, such as a printing mechanism, and a display lamp when the apparatus is out of operation. The second power switch, which is composed of a relay and the like, is controlled by a main control circuit.

In such a printing apparatus, in the case where the printing apparatus does not perform printing, for example, where data such as printing data or printing control codes are not inputted from an external host system, like a computer, for a predetermined length of time, the main control circuit turns off the second power switch to carry out auto power-off control to suppress the power consumption of specific parts, and thereafter, the apparatus is put into a power saving mode in which power is supplied only to the main control circuit and the peripheral circuits thereof. In the case where data input is restarted from the external host system in this power saving mode, the second power switch is quickly turned on to activate the printing apparatus, thereby restoring the apparatus to the normal mode in which the apparatus is ready for printing. Also, in restoring to the normal mode, the power saving mode may be canceled forcibly through a panel switch operation by a user.

In this printing apparatus, the power consumption in power saving mode is very small, and therefore, the first power switch can be eliminated, by which a reduction in the number of parts and lowering of costs are realized.

As a similar related art, a data terminal unit directed to reduce power consumption has been disclosed (Japanese Unexamined Patent Publication JPA 57-155633 (1982)).

FIGS. 5A and 5B are control flowcharts for starting and releasing the power saving mode in a conventional printing apparatus, respectively. FIG. 5A shows a control routine for putting the apparatus into the power saving mode. The control routine is entered when the data input from an external host system stops for a predetermined length of time in the normal mode where the whole printing apparatus is supplied with power.

First, at step s1, counting with a power saving mode starting timer for measuring a predetermined length of time before putting the apparatus into the power saving mode is started, and at step s2, it is determined whether printing data is inputted from the external host system. When it is judged that the printing data is inputted, the process is shifted to step s3, where the timer is cleared, and then to step 4, where printing operations or feeding paper is carried out according to the printing data input. Then the process is returned to step s1.

When it is judged at step 2 that the printing data is not inputted, the process is shifted to step s5, where it is determined whether a predetermined length of time has passed from the start of counting with the power saving mode starting timer. Until it is judged that the predetermined length of time has lapsed, steps s2 and s5 are repeated. Upon judging that the predetermined length of time has lapsed, at step s6 the second power switch is turned off and supplying power is partially stopped, thus putting the apparatus into the power saving mode.

FIG. 5B shows a control routine for restoring the apparatus to the normal mode by canceling the power saving mode. First, at step p1, it is determined whether printing data has been inputted from the external host system. In the case where the data has been inputted, at step p3, the apparatus is restored from the power saving mode to the normal mode. In the case where it is judged at step p1 that the data has not been inputted, at step p2, it is determined whether the input operation has been performed on the operation panel. In the case where the input operation on the operation panel has not been performed, steps p1 and p2 are repeated. In the case where the input operation on the operating panel has been performed, the process is shifted to step p3, where the apparatus is restored to the normal mode.

However, when data is continuously transmitted from an external host system, in case of, for example, incorrect selection of data or paper size, it is desired to interrupt the printing operation of the printing apparatus. In such a case, in a printing apparatus provided with the first power switch, it is possible to interrupt the printing operation by turning off the first power switch. On the other hand, in a printing apparatus not provided with the first power switch, by operating a panel switch by a user, the apparatus is manually put into the power saving mode to stop the printing operation. Nevertheless, in the case where data is inputted from the external host system immediately after the manual stop of the printing operation, the power saving mode is immediately released and the printing operation is resumed, which is an operation against the user's will.

As a countermeasure, when the apparatus is put into the power saving mode during data transmission, the external host system may suspend subsequent data transmission and wait for restoration of the printing apparatus to the normal mode. As long as the power saving mode is continued, however, the external host system is required to be ready for resumption of data transmission, and therefore capabilities of processing other tasks are limited. Further, in the case of releasing the power saving mode and resuming the printing operation which was suspended midway, the remaining data yet to be printed are transmitted. Hence, an attempt to reprint all the data from the beginning requires a complicated operation.

It is also possible to prohibit the apparatus from being put into the power saving mode by an input from the operation panel while data is being received from an external host system and printed. In such a case, although the power saving mode is not released against user's will, the forcible stop of the printing operation becomes impossible.

As described above, with a printing apparatus in which the power saving mode is released by a data input from an external host system, a user's will may not be reflected in a manual stop during data receiving operation and printing operation.

SUMMARY OF THE INVENTION

It is hence an object of the invention to provide a printing apparatus capable of preventing the occurrence of an erro-

neous operation in entering into or releasing the power saving mode and a method of reducing the power consumption of the printing apparatus.

The invention provides a printing apparatus comprising:

an interface for transmitting and receiving a signal between the apparatus and an external host system;

an operation panel including signal input means;

an image former for forming an image on a recording medium;

a main controller for transmitting and receiving a signal among the interface, the operation panel and the image former and processing the signal in accordance with a predetermined program; and

a power supply controller for stopping or limiting a power supply to the image former in accordance with a command from the main controller; wherein

the power supply controller is activated on the basis of a predetermined signal input from the operation panel and the apparatus can be transferred to a power saving mode.

According to the invention, the printing apparatus can be transferred to the power saving mode any time in response to a user's will. As a result, the power consumption can be reduced while the apparatus is out of operation.

It is preferable in the invention that in the process of transfer to the power saving mode on the basis of the signal input from the operation panel, transferring the apparatus into the power saving mode can be canceled on the basis of a signal input from the operation panel.

Once the printing apparatus has been put into the power saving mode, restoration to normal mode requires a certain length of time for warming up the driving system or setting data. Assuming a transfer to the power saving mode due to an erroneous operation of the user, it is determined whether the canceling operation has been performed or not, and consequently inadvertently putting the apparatus into the power saving mode can be avoided.

It is preferable in the invention that the power saving mode is canceled on the basis of a signal input from the operation panel while the apparatus is in the power saving mode.

More specifically, even after the printing apparatus has been transferred to the power saving mode, the printing apparatus can be restored to normal operation any time in response to a user's will, thereby eliminating the inconveniences of the user.

It is preferable in the invention that the printing apparatus is transferred to the power saving mode on the basis of a signal input from the operation panel after the lapse of a predetermined length of time.

In other words, as described above, to allow the user to cancel the designation of the power saving mode immediately after the designation, a predetermined length of time is allowed for confirming whether canceling putting the apparatus into the power saving mode has been issued.

The invention also provides a printing apparatus wherein:

when a signal input from an external host system stops for a predetermined length of time, or when a predetermined signal input from the operation panel occurs, the power supply controller is activated and the printing apparatus is transferred into the power saving mode,

the power saving mode is canceled by a signal input from either the external host system or the operation panel, and

when the signal input from the operation panel, commanding the power saving mode, occurs during transmission of printing data from the external host system, the printing apparatus is transferred to the power saving mode after the lapse of a predetermined length of time from completion of the data transmission.

According to the invention, since transmission of a series of data from the external host system is completed by the time of transfer to the power saving mode, the conventional inconvenience of immediate restoration to the normal mode by the remaining data retransmission after transfer to the power saving mode is eliminated. Consequently, the power saving mode can be started according to user's will.

The external host system can transmit a series of printing data at a time and therefore the external host system is not restricted by the state of the printing apparatus transferred to the power saving mode, with the result that the external host system is released from the data transmission task.

It is preferable in the invention that the printing apparatus comprises data storage means for storing printing data sent from the external host system, and

when the printing apparatus is transferred to the power saving mode on the basis of a signal input from the operation panel, the printing data from the external host system is not stored in the data storage means.

More specifically, by eliminating the step of storing the printing data from the external host system in the data storage means when transferring to the power saving mode, the time required for transferring a series of data is shortened, so that quick transfer to the power saving mode is made possible. The data transmission task can also be completed quickly.

It is preferable in the invention that the interface is based on a parallel interface including a busy signal, a strobe signal and a plurality of data signals, and in the case where the printing apparatus is transferred to the power saving mode on the basis of a signal input from the operation panel, the busy signal is held at a low level to permit the external host system to continuously perform the data transmission operation.

More specifically, by holding the busy signal at a low level, the external host system judges that the printing apparatus is always ready for receiving data. Consequently transmission of a series of data can be completed for a very short period.

It is preferable in the invention that by detecting the strobe signal, it is judged that the data transmission operation of the external host system is completed.

More specifically, the strobe signal is a signal for informing the printing apparatus that the transmission data from the external host system has been outputted, so that the operating conditions of the external host system can be reliably judged by detecting the presence or absence of the strobe signal.

The invention also provides a method of saving power of a printing apparatus.

The method comprising the step of activating the power supply controller on the basis of a predetermined signal input from the operation panel and thereby transferring the apparatus to the power saving mode.

According to the invention, the printing apparatus can be transferred to the power saving mode any time according to a user's will, and therefore the power consumption while the apparatus is out of operation can be reduced.

The invention also provides a method of saving power of a printing apparatus comprising the steps of:

in the case where a signal input from an external host system stops for a predetermined length of time, or in the case where a predetermined signal input from the

operation panel occurs, activating the power supply controller to thereby transfer the printing apparatus into the power saving mode,

canceling the power saving mode by a signal input from either the external host system or the operation panel, and

in the case where the signal input from the operation panel, commanding the power saving mode, occurs during transmission of printing data from the external host system, transferring the printing apparatus to the power saving mode after the lapse of a predetermined length of time from completion of the data transmission.

According to this method, since transmission of a series of data from the external host system is completed by the time of transfer to the power saving mode, the conventional inconvenience of immediate restoration to the normal mode by the remaining data retransmission after transfer to the power saving mode is eliminated. Consequently, the power saving mode can be started according to the user's will.

The external host system can transmit a series of printing data at a time and therefore is not restricted by the state of the printing apparatus transferred to the power saving mode, with the result that the external host system is released from the data transmission task.

BRIEF DESCRIPTION OF THE DRAWINGS

Other and further objects, features, and advantages of the invention will be more explicit from the following detailed description taken with reference to the drawings wherein:

FIG. 1 is a block diagram showing an electrical configuration of an embodiment of the invention;

FIG. 2 is a flowchart showing an operation of putting the apparatus into the power saving mode;

FIG. 3 is a timing diagram showing a procedure for transmitting data in the normal mode

FIG. 4 is a timing diagram showing a procedure for transmitting data in step a5 of FIG. 2; and

FIGS. 5A and 5B are control flowcharts for putting the apparatus into and canceling the power saving mode in a conventional printing apparatus.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Now referring to the drawings, preferred embodiments of the invention are described below.

FIG. 1 is a block diagram showing an electrical configuration of an embodiment of the invention. A printing apparatus comprises a main control circuit **1** for controlling the operation of the whole apparatus, an image-forming section **10** for forming characters and images on a recording medium while transporting the recording medium, an interface (I/F) **8** for transmitting and receiving signals between the printing apparatus and an external host system **9** such as computer, and an operation panel **20** in which signal input means such as an operating switch and signal display means such as an LED (light-emitting diode) are incorporated. These components are connected to each other by a bus **21** composed of a plurality of signal lines.

The main control circuit **1** comprises a CPU (central processing unit) **2**, a ROM (read-only memory) **6** which is a nonvolatile memory, and a RAM (random access memory) **7** where data can be rewritten.

The CPU **2** performs such signal processing operations as data input/output, data transfer and arithmetic operations according to a program stored in the ROM **6**, and includes a timer for measuring a lapse time and an interrupt generation circuit for receiving an interrupt signal from the interface **8** and the operation panel **20**.

In the ROM **6** a control program and data required for the operation of the CPU **2** and data required for printing such as character-codes and -fonts are stored. The RAM **7** is used as a work area of the CPU **2**, a receiving buffer for temporarily storing the data received from the external host system **9**, a printing buffer for developing bitmap data to be printed and the like.

The image-forming section **10** includes a printing head **13** for printing on the recording medium, a CR (carriage) motor **14** for transporting a carriage mounting the printing head **13** along the width direction of the recording medium, a PF (paper feed) motor **15** for transporting by a predetermined amount, inserting or ejecting the recording medium, a drive circuit **12** for driving these components, and a control circuit **11** for controlling the drive circuit **12** on the basis of a command from the main control circuit **1**.

The interface **8** receives such data as printing data and printing control codes sent from the external host system **9** and outputs them to the main control circuit **1**, or conversely receives the status information of the printing apparatus from the main control circuit **1** and transmits them to the external host system **9**. The external host system **9** and the interface **8** are connected to each other, for example, by a parallel interface scheme called the Centronix standard, under which typical signals are defined a busy signal BUSY, an error signal ERR, a strobe signal STB and data signals DATA 1 to 8. The strobe signal STB outputted from the external host system **9**, which is low-active, is normally at level "1" (high level). After the external host system **9** outputs the data signals DATA 1 to 8 to the printing apparatus, the strobe signal STB turns to "0" (low-level) state, and after a predetermined time, returns to "1" state. This operation is repeated to transfer data byte by byte. As long as the strobe signal STB remains in "0" state, the interface **8** sets the busy signal BUSY to "1" state for a predetermined length of time and makes the external host system **9** ready for transmission. The error signal ERR, on the other hand, turns to "0" state and suspends the transmission operation of the external host system **9** in the case where the printing apparatus develops an irreparable malfunction. Although the foregoing description of the embodiment concerns the case using the parallel interface scheme, the invention is applicable with effect to the serial interface scheme such as RS-232C.

The operation panel **20** includes signal input switches including a switch for selecting between on-line and off-line modes of the printing apparatus, a switch for commanding insertion/ejection or line spacing of the recording paper, and a switch for putting the apparatus into the power saving mode by interrupting the operation of the CPU **2**. The operation panel **20** further includes a signal display lamp such as an LED adapted to turn on when the printing apparatus is ready for printing. The on-line mode is defined as the one in which a signal input from the external host system **9** is allowable and the operation is performed on the basis of the signal while partially restricting a signal input from the operation panel **20**. The off-line mode, on the other hand, is defined as the one in which a signal input from the external host system **9** is limited while at the same time a signal input from the operation panel **20** is allowable and the printing apparatus performs on the basis of the signal input.

This printing apparatus comprises a logic power supply **30** for supplying electric power to a logic circuit for handling

digital signals, and a drive power supply **31** for supplying electric power to a unit requiring a comparatively large power such as a motor. A power supply unit **35** is supplied with power from a commercial power supply of 100V AC etc. and after voltage conversion and rectification, supplies, for example, 5V DC to the logic power supply **30** and 20V DC to the drive power supply **31**.

The logic power supply **30** outputs 5V DC which is adapted to TTL (transistor transistor logic) or CMOS (complementary metal oxide semiconductor), to a power line V1 and supplies power to the main control circuit **1**, the interface **8** and the operation panel **20**. A part of the power line V1 also supplies power to a part of the operation panel **20** and the control circuit **11** of the image-forming section **10** as a power line V2 through the power cutoff circuit **32** such as a relay. The drive power supply **31** supplies power to the drive circuit **12** of the image-forming section **10** as a power line V3 through the power cutoff circuit **33** such as a relay. The power cutoff circuits **32** and **33** supply power to the power lines V2 and V3 when a power saving signal SP from the CPU **2** is in "1" state, and interrupts the power supply to the power lines V2 and V3 when the power saving signal SP is in "0" state.

Now, the power saving mode of a printing apparatus will be described. With respect to transfer of the printing apparatus to the power saving mode, the following two conditions are possible: (a) when the signal input from the external host system **9** stops for a predetermined length of time, and (b) when a signal is inputted from the operation panel **20**. First, with regard to the condition (a), a timer is activated each time a signal is inputted from the external host system **9**, and with the lapse of a predetermined length of time from the last signal input, the CPU **2** maintains the power saving signal SP in "0" state and the apparatus is put into the power saving mode. With condition (b), on the other hand, when a specific switch is pressed on the operation panel **20**, the CPU **2** maintains the power saving signal SP in "0" state and the apparatus is put into the power saving mode.

The cancellation of the power saving mode will be explained. The following two conditions are possible with respect to restoration of the printing apparatus from the power saving mode to the normal mode: (c) when a signal input from the external host system **9** begins, and (d) when a signal is inputted from the operation panel **20**. First, with regard to (c), upon reversal of the strobe signal STB from the external host system **9** to "0" state, the interface **8** detects the level change and generates an interrupt signal to the CPU **2**, which in turn executes a control program corresponding to the interrupt. At the same time, while maintaining the power saving signal SP in "1" state, the apparatus returns to the normal mode. On the other hand, with regard to (d), upon depression of a specific switch of the operation panel **20**, an interrupt signal is applied to the CPU **2**, which in turn executes a control program corresponding to the particular interrupt and the apparatus returns to the normal mode while maintaining the power saving signal SP in "1" state.

FIG. **2** is a flowchart showing the operation for putting the apparatus into the power saving mode. First, at step a1 it is judged whether a signal input from the external host system **9** stops for a predetermined length of time and putting the apparatus into the power saving mode is designated by the timer on the basis of the lapse of a predetermined length of time. In the case where putting the apparatus into the power saving mode is so designated, the process proceeds to step a3, where the printing head **13**, the CR motor **14** and the PF motor **15** of the image-forming section **10** are temporarily stopped.

In the case where it is judged at step a1 that putting the apparatus into the power saving mode is not designated, it is judged at step a2 whether putting the apparatus into the power saving mode is designated by a signal input from the operation panel **20**. In the case where it is judged at step a2 that putting the apparatus into the power saving mode is not designated, the process is terminated and the normal mode is continued. In the case where it is judged at step a2 that putting the apparatus into the power saving mode is designated through the operation panel **20**, the operation of each driving system of the image forming section **10** is temporarily stopped at step a3.

It is judged at step a4 whether putting the apparatus into the power saving mode is designated on the basis of the lapse of a predetermined length of time or through the operation panel. With the designation on the basis of the lapse of a predetermined length of time, the process proceeds to step a9, where the apparatus is put into the power saving mode, so that the CPU **2** sets the power saving signal SP to "0" state. The power cutoff circuits **32** and **33** are thus activated to stop power supply to the image forming section **10**, etc.

In the case where it is judged at step a4 that putting the apparatus into the power saving mode is designated through the operation panel, the process proceeds to step a5, where the busy signal BUSY of the interface section **8** is forcibly cleared to "0" state, thereby permitting data transmission of the external host system **9**.

FIG. **3** is a timing diagram showing a procedure for data transmission in normal mode. The external host system **9** constantly monitors the busy signal BUSY of the interface **8**, and when the busy signal BUSY is put into "0" state, the external host system **9** outputs printing data as data signals DATA 1 to 8. The strobe signal STB is inverted to "0" state at the time point when the data signals are stabilized. Next, the printing apparatus turns the busy signal BUSY to "1" state and thus holds the external host system **9** in the waiting state for data transmission. A little time later, the data signals DATA 1 to 8 are stored in the receiving buffer of the RAM **7**, and in order to resume the next data transfer, the busy signal BUSY is set to "0" state. By repeating this procedure, byte-by-byte data transfer is sequentially accomplished.

FIG. **4** is a timing diagram showing a procedure for data transmission of step a5 in FIG. **2**. When data transmission by the external host system **9** is permitted by clearing the busy signal BUSY of the interface **8** to "0" state, the external host system **9** outputs printing data as data signals DATA 1 to 8 and inverts the strobe signal STB to "0" level. Nevertheless, the busy signal BUSY is still held at "0" level, and the external host system **9** begins the next data transfer. Byte-by-byte data transfer is thus continuously accomplished. The interval between data transfers, which is dependent on the operating speed of the external host system **9**, is generally about several μsec to several hundred msec. In the process, the printing apparatus receives and discards the transmitted printing data without storing them in the RAM **7**, which printing data are not utilized for the printing operation. Any method in which the transmitted printing data is ignored is acceptable. The reception and discharge of the printing data transmitted from the external host system **9** can thus be realized.

At step a5 in FIG. **2**, the busy signal BUSY is cleared to "0" state, followed by step a6, where counting with a 10-sec timer is started. Then it is judged at step a7 whether the strobe signal STB has inverted from "1" to "0" state.

The foregoing description concerns the case in which the fall of the strobe signal STB is detected. Nevertheless, a

method is also acceptable in which the rise or level of the signal is detected. The counting time of the timer is set to 10 seconds because a considerable allowance is incorporated against the data transfer interval of the external host system 9 which is about several μ sec to several hundred msec. The counting time therefore is not necessarily limited to 10 seconds.

In the case where it is judged at step a7 that the strobe signal STB has reversed from "1" to "0" state, that indicates that new printing data is inputted. The input printing data is discharged, and at step a10 the 10-sec timer is reset, followed by step all, where the counting with the timer is resumed. At step a12 it is judged whether cancellation of the designation for putting the apparatus into the power saving mode is designated by a signal input from the operation panel **20**. In the case where such cancellation is not designated, the process returns to step a7, where counting with the timer is resumed. In the case where cancellation of the start of the power saving mode is designated by the operation panel **20**, the process proceeds to step a13. The operation of the printing head **13**, the CR motor **14** and the PF motor **15** of the image forming section **10** thus is restored, thereby completing the routine.

On the other hand, in the case where the strobe signal STB is not inverted at step a7, the process proceeds to step a8, where it is determined whether the 10-sec timer has completed the count. Before the counting time of 10 seconds, the process proceeds to step a12, and in the case where a designation through the operation panel **20** is not conducted, the process returns to step a7, where the count with the timer is continued. In the case where at step a8 it is judged that the 10-see timer has timed out, the process proceeds to step a9 where the power saving mode is started, so that the CPU **2** activates the power cutoff circuits **32** and **33** by setting the power saving signal SP to "1" state and thus stops power supply to the image-forming section **10**, etc.

Thus, in the case where the power saving mode is started forcibly by a command from the operation panel **20** in this way, the transmission data from the external host system **9** is received and discharged by holding the busy signal BUSY at "0" state, and the power saving mode is started after completion of the entire transmission task of the external host system **9**.

Restoration from power saving mode to normal mode is performed, as shown in FIG. **5B**, by data input from the external host system **9** or by a signal input from the operation panel **20**.

Although in the above-mentioned embodiments a mechanical switch for the power cutoff circuits **32** and **33** such as a relay is used, the invention is of course applicable also in the case where the CPU is set in HALT state or the clocks supplied to each part are stopped for suppressing power consumption by the peripheral circuits and the drive means.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description and all changes which come within the meaning and the range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed is:

1. A printing apparatus comprising:

interface means for transmitting and receiving a signal between the apparatus and an external host system;

an operation panel including signal input means;

image forming means for forming an image on a recording medium;

main control means for transmitting and receiving a signal among the interface means, the operation panel and the image forming means and processing the signal in accordance with a predetermined program; and

power supply control means for stopping or limiting a power supply to the image forming means in accordance with a command from the main control means; wherein

the power supply control means is activated on the basis of a predetermined signal input from the operation panel and the apparatus is transferred to a power saving mode.

2. The printing apparatus of claim **1**, wherein

in the process of transfer to the power saving mode on the basis of the signal input from the operation panel, transferring the apparatus into the power saving mode is canceled on the basis of a signal input from the operation panel.

3. The printing apparatus of claim **1**, wherein

the power saving mode is canceled on the basis of a signal input from the operation panel while the apparatus is in the power saving mode.

4. The printing apparatus of claim **1**, wherein

the printing apparatus is transferred to the power saving mode on the basis of a signal input from the operation panel after the lapse of a predetermined length of time.

5. A printing apparatus comprising:

interface means for transmitting and receiving a signal between the apparatus and an external host system;

an operation panel including signal input means;

image forming means for forming an image on a recording medium;

main control means for transmitting and receiving a signal among the interface means, the operation panel and the image forming means and processing the signal in accordance with a predetermined program; and

power supply control means for stopping or limiting a power supply to the image forming means in accordance with a command from the main control means; wherein

when a signal input from an external host system stops for a predetermined length of time, or when a predetermined signal input from the operation panel occurs, the power supply control means is activated and the printing apparatus is transferred into a power saving mode,

the power saving mode is canceled by a signal input from either the external host system or the operation panel, and

when the signal input from the operation panel, commanding the power saving mode, occurs during transmission of printing data from the external host system, the printing apparatus is transferred to the power saving mode after the lapse of a predetermined length of time from completion of the data transmission.

6. The printing apparatus of claim **5**, wherein

the printing apparatus comprises data storage means for storing printing data sent from the external host system in a normal mode, and

when the printing apparatus is transferred to the power saving mode on the basis of a signal input from the operation panel, the printing data from the external host system is not stored in the data storage means.

7. The printing apparatus of claim 6, wherein

the interface means is based on a parallel interface including a busy signal, a strobe signal and a plurality of data signals; and

when the printing apparatus is transferred to the power saving mode on the basis of a signal input from the operation panel, the busy signal is held at a low level to permit the external host system to continuously perform the data transmission operation.

8. The printing apparatus of claim 5, wherein

the interface means is based on a parallel interface including a busy signal, a strobe signal and a plurality of data signals, and

by detecting the strobe signal, it is determined that the data transmission operation of the external host system is completed.

9. A method of saving power of a printing apparatus; the printing apparatus including

interface means for transmitting and receiving a signal between the apparatus and an external host system;

an operation panel including signal input means;

image forming means for forming an image on a recording medium;

main control means for transmitting and receiving a signal among the interface means, the operation panel and the image forming means and processing the signal in accordance with a predetermined program; and

power supply control means for stopping or limiting a power supply to the image forming means in accordance with a command from the main control means;

said method comprising the step of activating the power supply control means on the basis of a predetermined signal input from the operation panel and thereby transferring the apparatus to a power saving mode.

10. A method of saving power of a printing apparatus; the printing apparatus including

interface means for transmitting and receiving a signal between the apparatus and an external host system;

an operation panel including signal input means;

image forming means for forming an image on a recording medium;

main control means for transmitting and receiving a signal among the interface means, the operation panel and the image forming means and processing the signal in accordance with a predetermined program; and

power supply control means for stopping or limiting a power supply to the image forming means in accordance with a command from the main control means;

said method comprising the steps of:

activating the power supply control means and thereby transferring the printing apparatus into a power saving mode when a signal input from an external host system stops for a predetermined length of time, or when a predetermined signal input from the operation panel occurs;

canceling the power saving mode by a signal input from either the external host system or the operation panel, and

when the signal input from the operation panel, commanding the power saving mode, occurs during transmission of printing data from the external host system, transferring the printing apparatus to the power saving mode after the lapse of a predetermined length of time from completion of the data transmission.

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Hirai

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[54] **IMAGE COMMUNICATION APPARATUS**

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[52] **U.S. Cl.** **358/444**; 358/500; 358/434; 365/230.01

[58] **Field of Search** ..... 358/256, 257, 263, 261, 358/434, 442, 443, 444, 402, 401, 409, 480, 489, 375, 403, 407, 440, 406, 400, 437; 307/10.2, 9.1; 382/1; 365/230; 353/26 A; 395/111, 101, 143, 275

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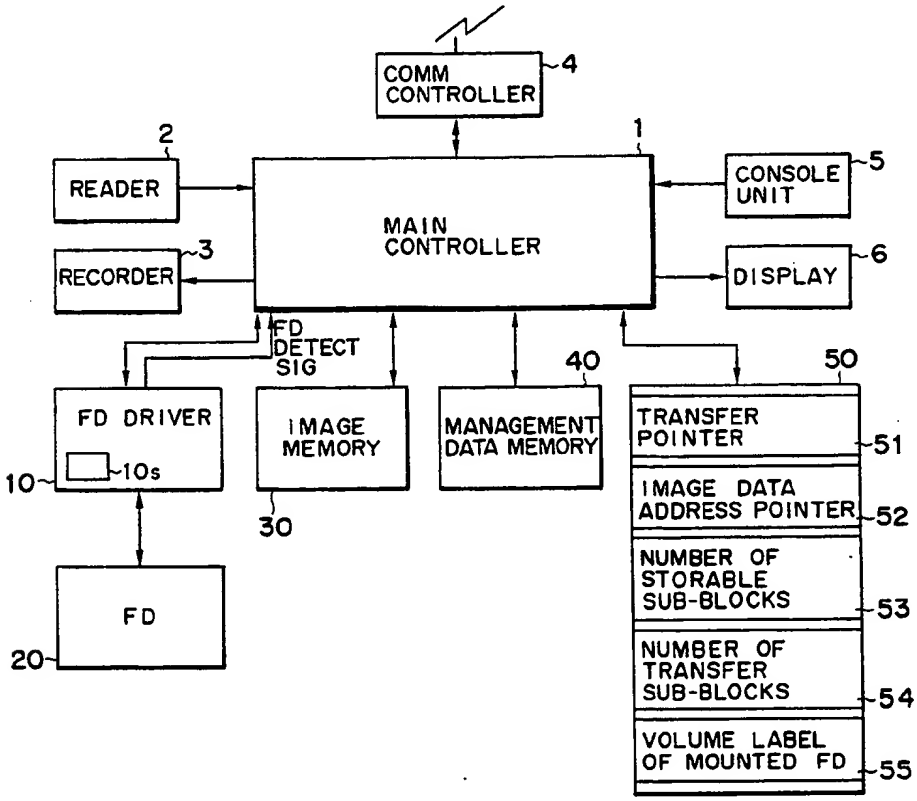
[57] **ABSTRACT**

An image communication apparatus, which stores image data in a first memory, and transfers the image data from the first memory to a detachable external storage medium, includes a detection unit for detecting an insertion/detachment state of the external storage medium, a transfer unit for transferring image data in the external storage medium to the first memory upon insertion of the external storage medium, and a delete unit for deleting the same image data stored in the first memory as the image data stored in the external storage medium upon detachment of the external storage medium.

10 Claims, 7 Drawing Sheets



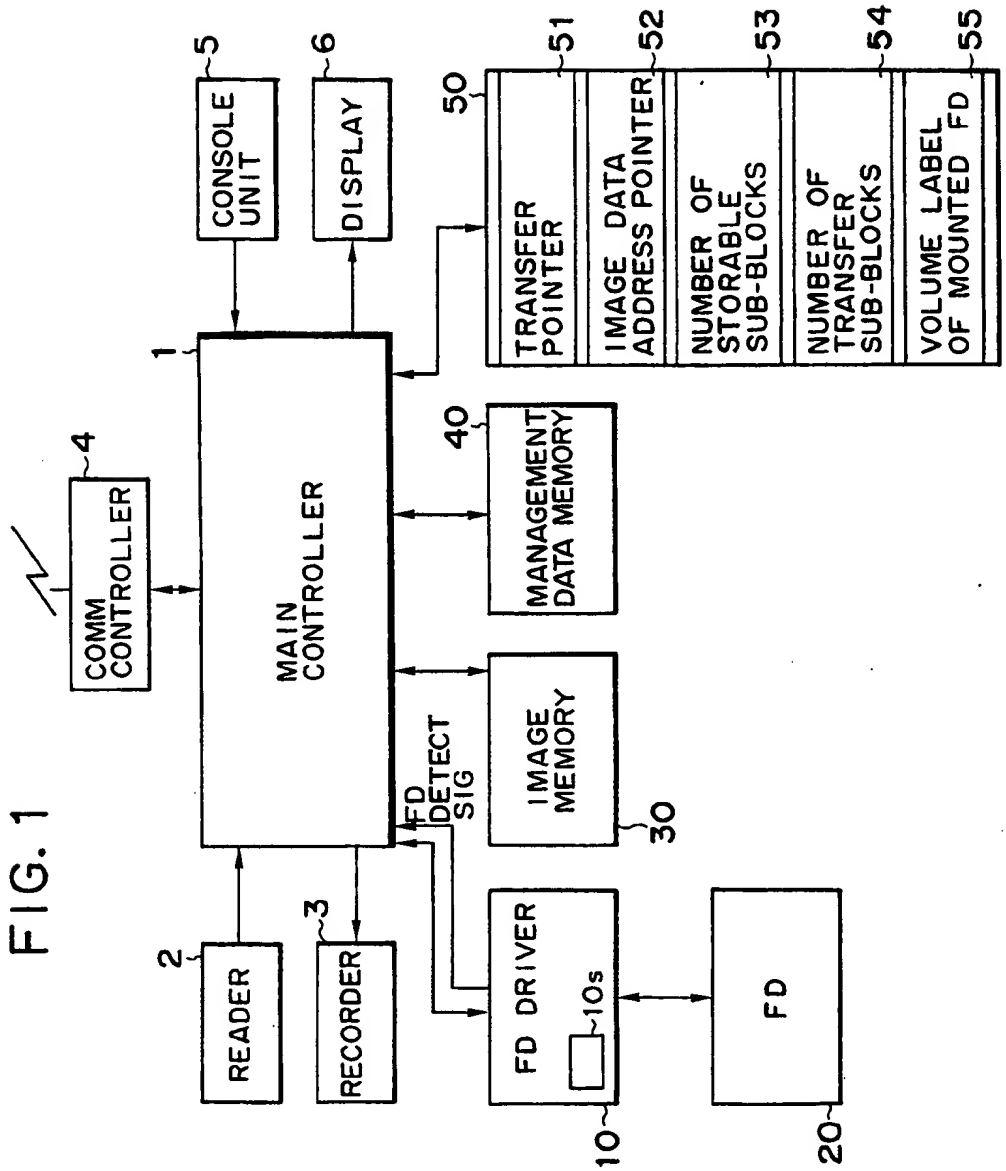

CONSOLE UNIT
DISPLAY
TRANSFER POINTER
IMAGE DATA ADDRESS POINTER
NUMBER OF STORABLE SUB-BLOCKS
NUMBER OF TRANSFER SUB-BLOCKS
VOLUME LABEL OF MOUNTED FD
50
51
52
53
54
55
5
6
1
4
COMM CONTROLLER
MAIN CONTROLLER
40
MANAGEMENT DATA MEMORY
IMAGE MEMORY
30
FD DETECT SIG
2
READER
3
RECORDER
FD DRIVER
10s
10
FD
20

FIG. 1

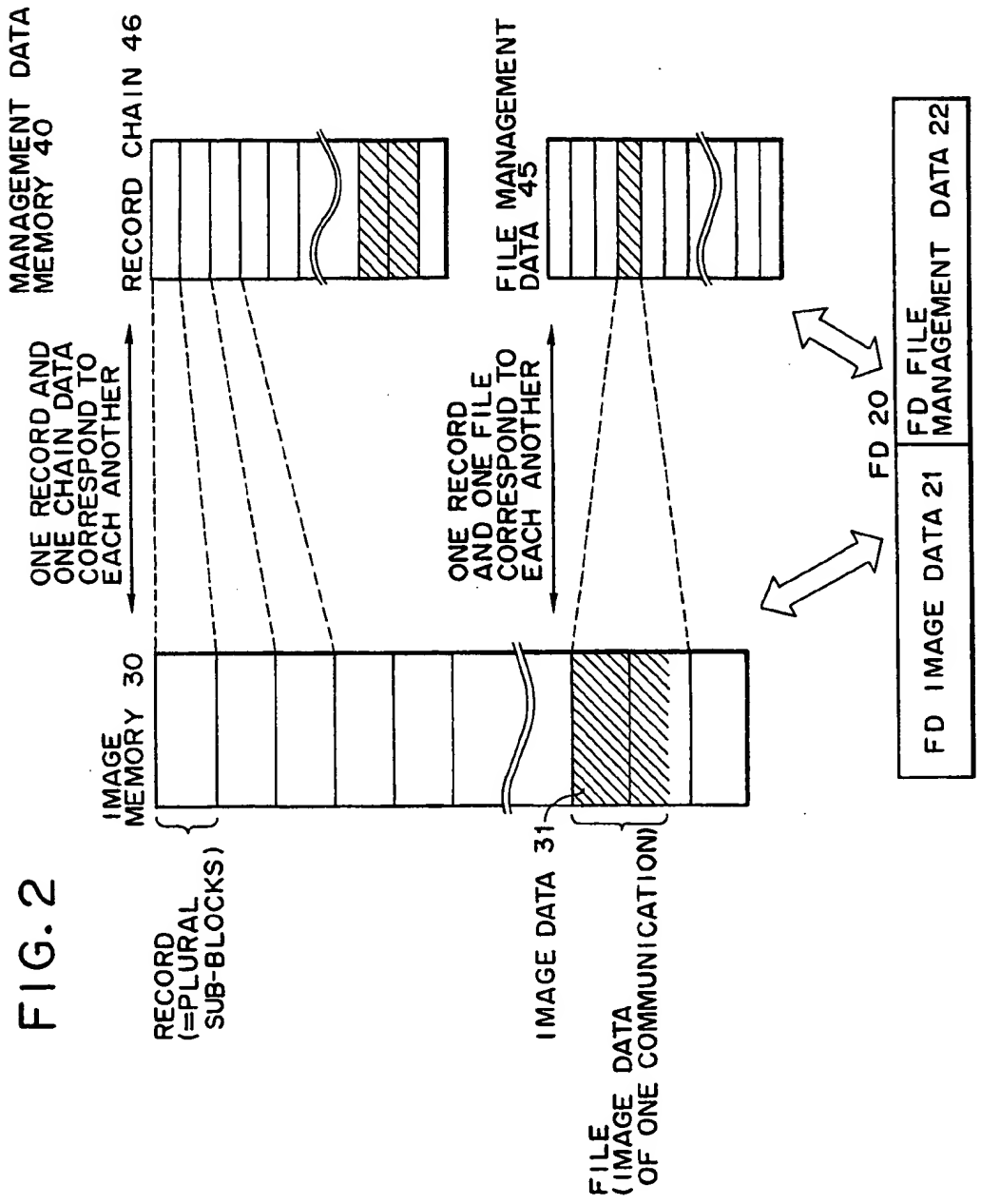

MANAGEMENT DATA MEMORY 40
RECORD CHAIN 46
FILE MANAGEMENT DATA 45
ONE RECORD AND ONE CHAIN DATA CORRESPOND TO EACH ANOTHER
ONE RECORD AND ONE FILE CORRESPOND TO EACH ANOTHER
FD 20
FD FILE MANAGEMENT DATA 22
FD IMAGE DATA 21
IMAGE MEMORY 30
RECORD (=PLURAL SUB-BLOCKS)
IMAGE DATA 31
FILE (IMAGE DATA OF ONE COMMUNICATION)

FIG. 2

FIG. 3

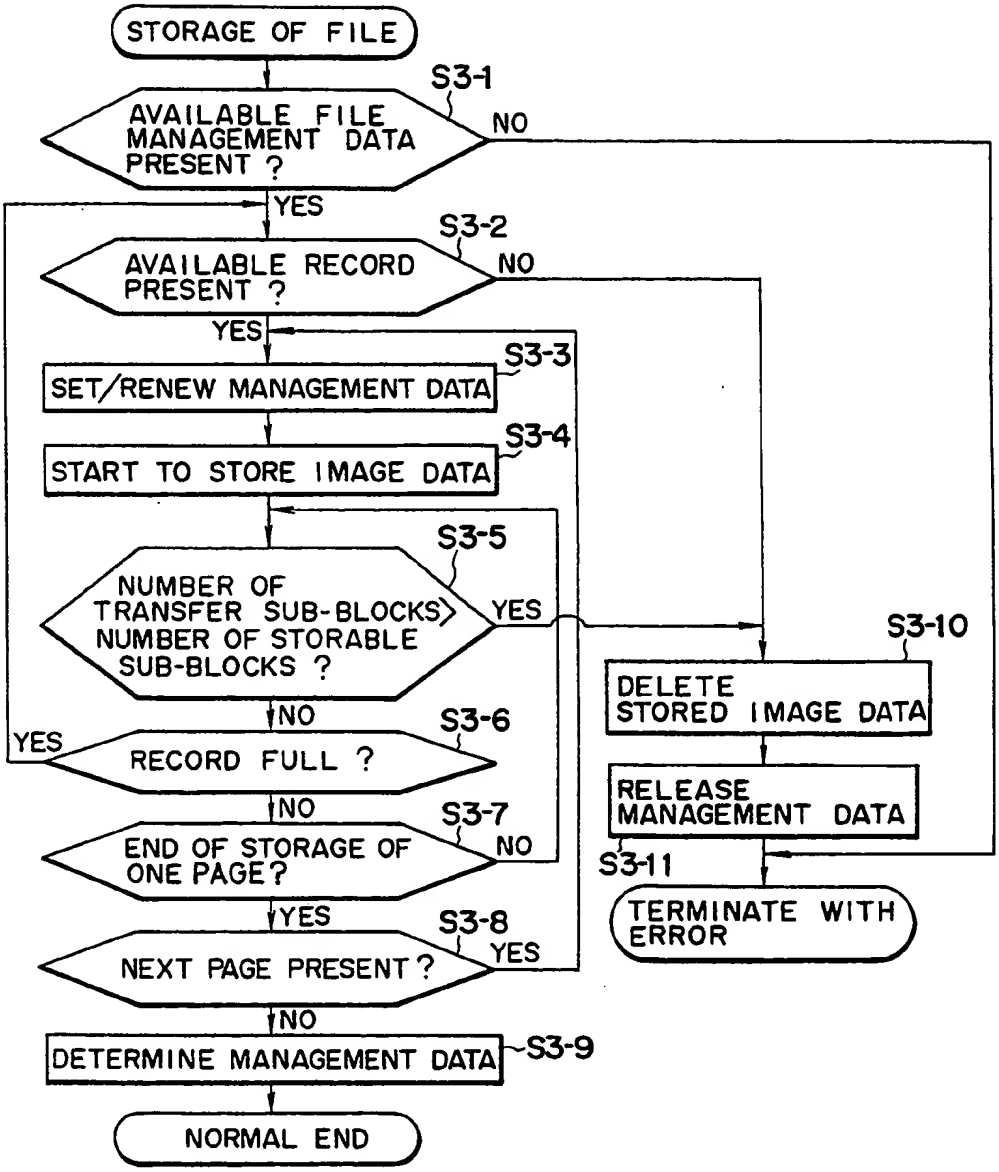

STORAGE OF FILE
S3-1
AVAILABLE FILE MANAGEMENT DATA PRESENT ?
NO
YES
S3-2
AVAILABLE RECORD PRESENT ?
NO
YES
S3-3
SET/RENEW MANAGEMENT DATA
S3-4
START TO STORE IMAGE DATA
S3-5
NUMBER OF TRANSFER SUB-BLOCKS > NUMBER OF STORABLE SUB-BLOCKS ?
YES
NO
S3-6
RECORD FULL ?
YES
NO
S3-7
END OF STORAGE OF ONE PAGE?
NO
YES
S3-8
NEXT PAGE PRESENT ?
YES
NO
S3-9
DETERMINE MANAGEMENT DATA
NORMAL END
S3-10
DELETE STORED IMAGE DATA
RELEASE MANAGEMENT DATA
S3-11
TERMINATE WITH ERROR

FIG. 4

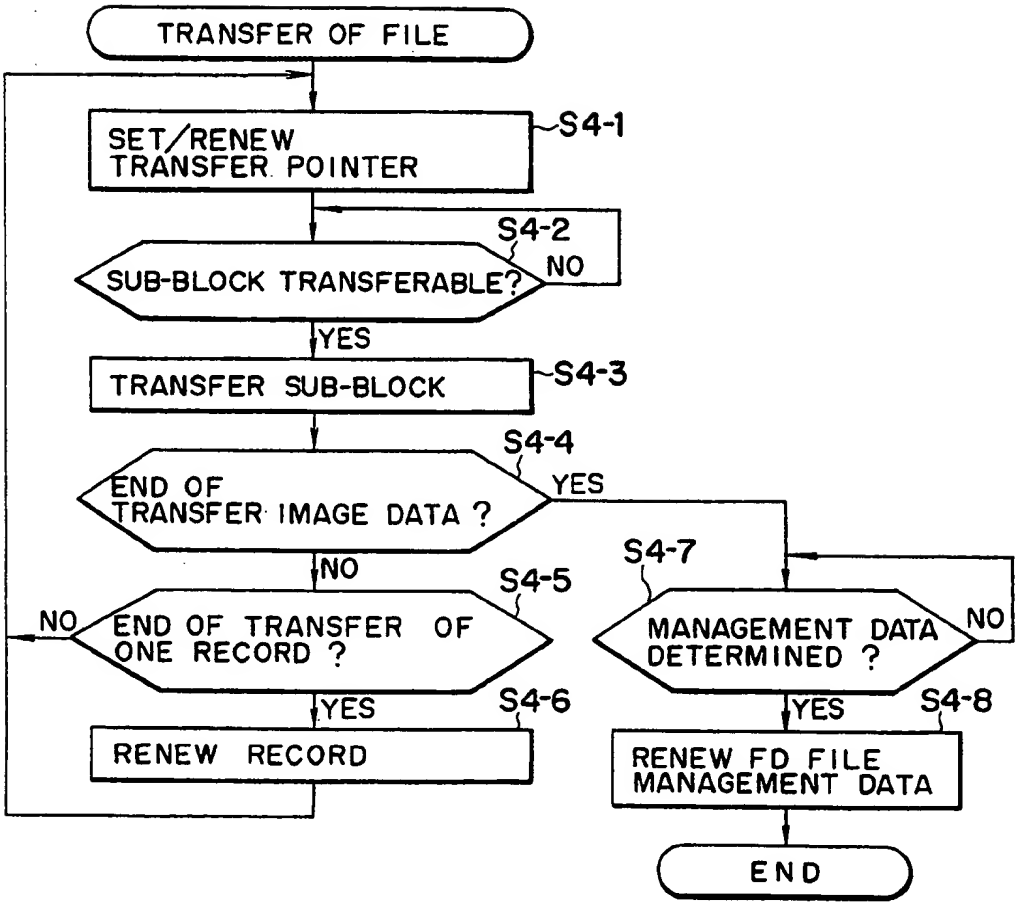
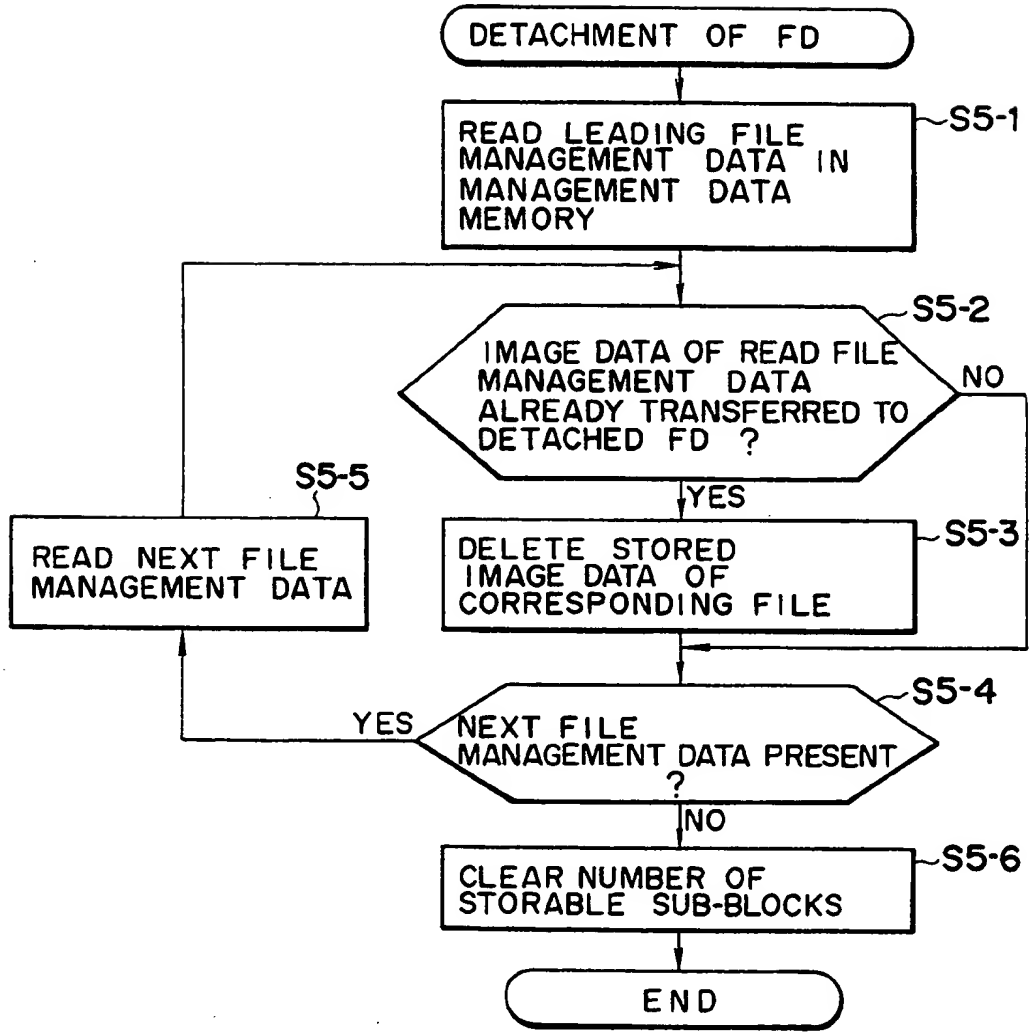

TRANSFER OF FILE
SET/RENEW TRANSFER POINTER
S4-1
S4-2
SUB-BLOCK TRANSFERABLE?
NO
YES
TRANSFER SUB-BLOCK
S4-3
S4-4
END OF TRANSFER IMAGE DATA ?
YES
NO
S4-5
NO
END OF TRANSFER OF ONE RECORD ?
YES
S4-6
RENEW RECORD
S4-7
MANAGEMENT DATA DETERMINED ?
NO
YES
S4-8
RENEW FD FILE MANAGEMENT DATA
END

FIG. 5



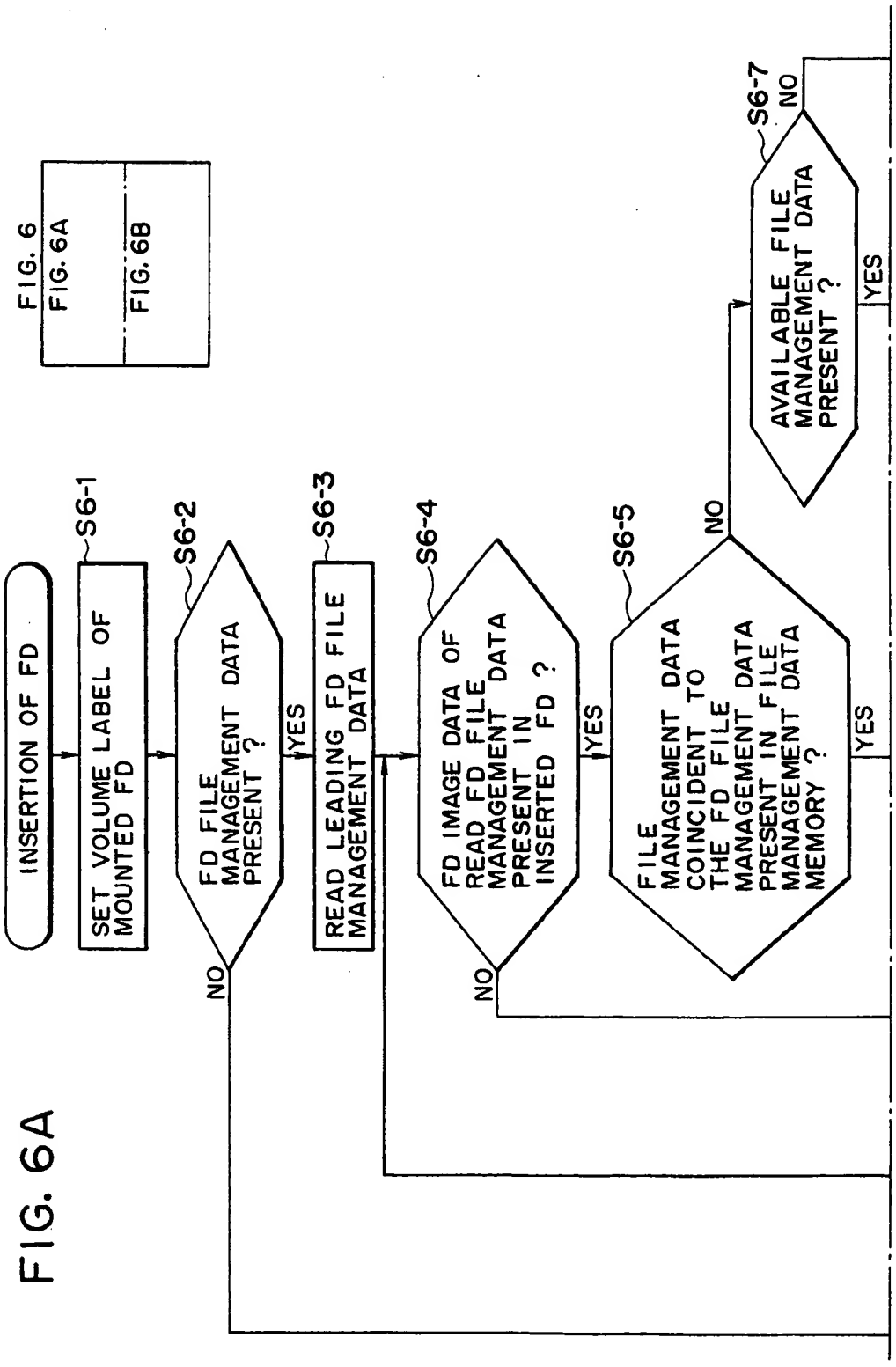


FIG. 6
FIG. 6A
FIG. 6B
INSERTION OF FD
S6-1
SET VOLUME LABEL OF MOUNTED FD
S6-2
FD FILE MANAGEMENT DATA PRESENT ?
YES
NO
S6-3
READ LEADING FD FILE MANAGEMENT DATA
S6-4
FD IMAGE DATA OF READ FD FILE MANAGEMENT DATA PRESENT IN INSERTED FD ?
YES
NO
S6-5
FILE MANAGEMENT DATA COINCIDENT TO THE FD FILE MANAGEMENT DATA PRESENT IN FILE MANAGEMENT DATA MEMORY ?
YES
NO
S6-7
AVAILABLE FILE MANAGEMENT DATA PRESENT ?
YES
NO

FIG. 6A

FIG. 6B

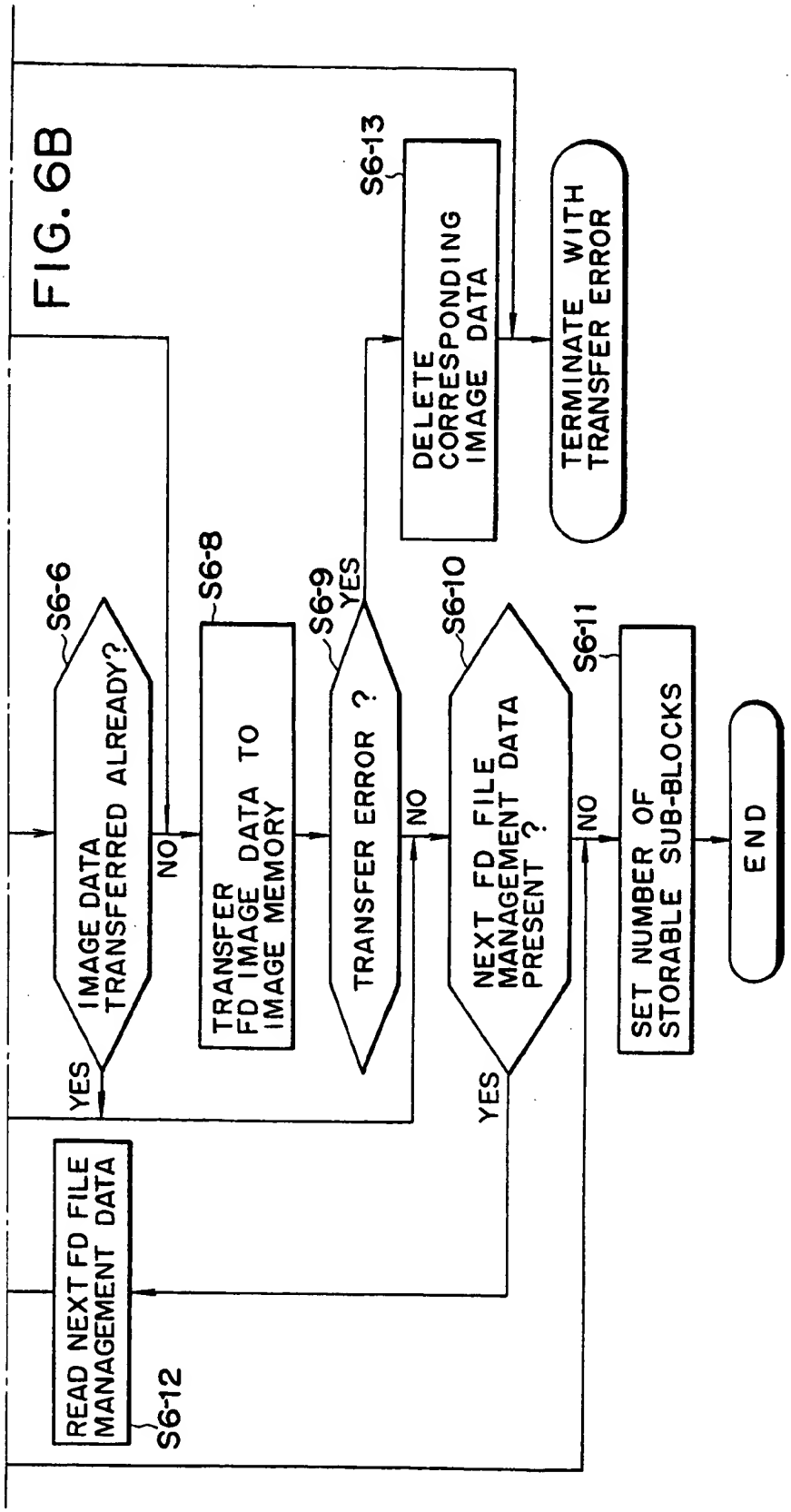

S6-6
IMAGE DATA TRANSFERRED ALREADY?
YES
NO
S6-8
TRANSFER FD IMAGE DATA TO IMAGE MEMORY
S6-9
TRANSFER ERROR ?
YES
NO
S6-13
DELETE CORRESPONDING IMAGE DATA
TERMINATE WITH TRANSFER ERROR
S6-10
NEXT FD FILE MANAGEMENT DATA PRESENT ?
YES
NO
S6-11
SET NUMBER OF STORABLE SUB-BLOCKS
END
S6-12
READ NEXT FD FILE MANAGEMENT DATA

IMAGE COMMUNICATION APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an image communication apparatus, which has a detachable external storage medium, and stores image data in external storage medium.

2. Related Background Art

In a conventional facsimile apparatus, a semiconductor memory is known as a storage medium for storing image data. Recently, as storage media which can hold data while a power supply is OFF, a hard disk, a floppy disk (to be referred to as an FD hereinafter), and the like are used.

Of these storage media, when a low-speed storage medium such as an FD is used, image data is temporarily stored in a high-speed storage medium (first storage medium) such as a D-RAM, and the stored image data is then transferred to a low-speed storage medium (second storage medium) such as an FD, so that the processing speed of the overall system is not decreased.

After the image data is transferred, the D-RAM holds the image data. When the image data is used, it can be directly read out from the high-speed D-RAM. More specifically, the FD serves as a back-up medium for the D-RAM, which is used when image data stored in the first storage medium is lost due to, e.g., an OFF operation of the power supply.

In the prior art, however, a detached FD is inserted in another facsimile apparatus, so that image data stored in the inserted FD can be transmitted, printed out, and so on. At the same time, since the same image data is held in the D-RAM in the original facsimile apparatus, the image data can be transmitted, printed out, and so on.

In this manner, since the D-RAM and the FD store the same image data, and since the FD is detachable, image access operations such as a transmission operation, a print-out operation, and the like undesirably overlap each other.

As applications associated with an image communication apparatus which stores image data in a detachable storage medium such as an FD, U.S. Pat. Nos. 4,827,349, 4,910,785, and 4,900,902, and U.S. patent application Ser. Nos. 07/269,733, 07/446,479, 07/707,034, and 07/615,149 are known.

However, applications that can solve the above-mentioned problems have not been proposed yet.

SUMMARY OF THE INVENTION

It is an object of the present invention to improve an image communication apparatus in consideration of the above-mentioned problems.

It is another object of the present invention to provide an image communication apparatus, which can efficiently use a memory by deleting the same image data stored in the memory of the apparatus as that stored in an external storage medium while the detachable external storage medium is detached.

It is still another object of the present invention to provide an image communication apparatus, which can improve use efficiency of a memory by transferring image data stored in a detachable external storage medium to the memory of the apparatus upon insertion of the external storage medium, and by deleting the same image data stored in the memory of the apparatus as that stored in the external storage medium upon detachment of the external storage medium.

Other objects of the present invention will become apparent from the following detailed description of the preferred embodiments taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a block diagram showing an arrangement of a facsimile apparatus according to an embodiment of the present invention;

FIG. 2 shows a memory map of this embodiment;

FIG. 3 is a flow chart showing storage processing to an image memory 30 in this embodiment;

FIG. 4 is a flow chart showing transfer processing from the image memory 30 to an FD 20 in this embodiment;

FIG. 5 is a flow chart showing detachment processing of the FD 20 in this embodiment; and

FIG. 6 is a flow chart showing insertion processing of the FD 20 in this embodiment.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The preferred embodiment of the present invention will be described in detail hereinafter with reference to the accompanying drawings.

FIG. 1 is a block diagram showing an arrangement of a facsimile apparatus according to an embodiment of the present invention.

In FIG. 1, a main controller 1 controls the operation of the overall apparatus, and comprises a microprocessor, a program memory ROM, a work area RAM, and the like.

A reader 2 comprises a CCD image sensor, an original feed mechanism, and the like.

A recorder 3 comprises a thermal printer, an ink-jet printer, a laser printer, or the like.

A communication controller 4 comprises a modem, an NCU (network control unit), and the like.

A console unit 5 comprises, e.g., a keyboard.

A display 6 comprises, e.g., an LCD.

A floppy disk (FD) driver 10 is connected to the main controller 1.

A floppy disk (FD) 20 is detachable from the FD driver 10.

An image data storage memory (to be referred to as an image memory hereinafter) 30 such as a D-RAM is connected to the main controller 1.

An image management data storage memory (to be referred to as a management data memory hereinafter) 40 such as an S-RAM is connected to the main controller 1.

A control data storage memory 50 such as an S-RAM is also connected to the main controller 1.

FIG. 2 shows the relationship among the memories in this embodiment.

The image memory 30 is a storage medium for storing image data 31, and is an example of the first storage medium. The image memory 30 is constituted a plurality of main blocks (records) each having a predetermined size, and each main block is constituted by a plurality of sub-blocks each having a predetermined size. The first page of image data of one communication (=file) is stored from the beginning (from the beginning of sub-block number 0) of the main block, and each page in the file is stored from the beginning of a correspond-

ing sub-block. Data transfer with the FD **20** is performed in units of sub-blocks.

The management data memory **40** is a storage medium for storing image management data **41** for managing the image data **31**. The image management data **41** includes file management data **45** for managing files, a record chain **46** for managing the records in the image memory **30**, and the like.

The file management data **45** stores page data such as a use state of a file in the image memory **30** or the FD **20**, the storage start and end positions of pages in the file (block numbers in the image memory **30** or FAT numbers in the FD **20**), and the like, a name (to be referred to as a volume label hereinafter) assigned to the FD **20** which stores the corresponding image data, a file name in the FD **20**, and the like.

The record chain **46** stores the use states of the records, the presence/absence of the next record, the next record number, and the like in correspondence with the records in the image memory **30**.

The FD **20** is a storage medium for storing FD image data **21**, and FD file management data **22** for managing the FD image data **21**, and is an example of the second storage medium. Note that an area for storing the FD file management data **22** is assured in advance in the FD **20** independently of an area for storing the FD image data **21**. The FD file management data **22** is renewed on the basis of the file management data **45** every time the content of the FD **20** is renewed.

The FD driver **10** has an FD detect sensor **10s** for detecting the insertion/detachment state of the FD **20**, and generating an FD detect signal. The main controller **1** discriminates the insertion/detachment state of the FD **20** on the basis of the FD detect signal from the FD detect sensor **10s**.

The control data storage memory **50** is a memory for storing a transfer pointer **51**, an image data address pointer **52**, the number **53** of storable sub-blocks, the number **54** of transfer sub-blocks, and a volume label **55** of a mounted FD.

The transfer pointer **51** is used when data is transferred from the image memory **30** to the FD **20**. The pointer **51** indicates a sub-block which is being transferred or waits for transfer, and is renewed to indicate the next sub-block upon completion of the transfer of the corresponding sub-block.

The image data address pointer **52** indicates an address next to the end address of the image data **31**, which is being stored in the image memory **30**, i.e., an address at which the image data **31** is to be stored next. Dummy data is stored in this pointer in a state other than the storage operation.

The number **53** of storable sub-blocks is a value obtained by dividing, with the sub-block size, an available (unused) area of the area in the FD **20**, which area can be used for storing the FD image data **21** (as described above, the area for storing the FD file management data **22** is excluded in advance). For example, in the case of an FD having the MS-DOS ® format as one of operating systems, the number of storable sub-blocks is calculated by a file allocation table (FAT) as a management data section. The FAT divides the storage area of the FD **20** into blocks each having a given unit size, and stores the use states of the unit blocks and the next unit block number. The number **53** of storable sub-blocks is renewed when the content of the FD **20** is changed due to substitution reception, substitution reception image output, and the like or when the FD **20** itself is changed due to insertion or detachment of the FD **20**.

The number **54** of transfer sub-blocks is the number of sub-blocks of the image data **31**, which is being stored in the image memory **30**, and is to be transferred to the FD **20**. The number **54** of transfer sub-blocks is increased every time the sub-block is renewed, while the image data **31** is being stored in the image memory **30**. More specifically, the number **54** of transfer sub-blocks indicates the number of sub-blocks which store the image data **31**, which is being stored.

The volume label **55** of the mounted FD stores the volume label of the mounted FD **20**. This label is renewed when the FD **20** is inserted.

The operation of this embodiment will be described below.

FIG. **3** is a flow chart showing storage processing of the image data **31** for one file in the image memory **30** in this embodiment.

In FIG. **3**, the file management data **45** is referred to check the presence/absence of available file management data (S3-1). If NO in step S3-1, the processing is terminated with an error; otherwise, the record chain **46** is referred to check the presence/absence of an available record (S3-2). If NO in step S3-2, it is determined that the image memory **30** overflows; otherwise, the leading address of the record is set in the image data address pointer **52**. In addition, various values such as the storage start position in the file management data **45**, the use state of the corresponding record in the record chain **46**, and the like are set in the image management data **41** (S3-3).

When the storage operation (for one record) of the image data **31** is started (S3-4), the image data address pointer **52** is renewed as the storage operation progresses, and the number **54** of transfer sub-blocks is also renewed every time the sub-block is renewed. It is checked if the number **54** of transfer sub-blocks exceeds the number **53** of storable sub-blocks (S3-5). If NO in step S3-5, it is checked if the current record which is being subjected to the storage operation is filled with storage data (S3-6). If YES in step S3-6, the flow returns to step S3-2, and if the next record is present, the record chain **46** is renewed (S3-3). If NO in step S3-6, it is checked if an original for one page is ended (S3-7). If NO in step S3-7, the flow returns to step S3-5 to continue the storage operation. If YES in step S3-7, the presence/absence of the next original is checked (S3-8). If YES in step S3-8, the flow returns to step S3-3, and page data in the file management data **45** is renewed. If NO in step S3-8, an effective flag on the image memory, the storage end position, and the like in the file management data **45** are set to determine the image management data **41** (S3-9), and the storage processing is normally ended. A value obtained by subtracting the number **54** of transfer sub-blocks from the number **53** of storable sub-blocks is set in the number **53** of storable sub-blocks, and the number **54** of transfer sub-blocks is cleared.

In, e.g., a G3 reception mode, whether or not an original for one page is ended is determined in step S3-7 by checking if an RTC (return to control) in the CCITT recommendation T.4 is received. If the RTC is received, it is determined that the original for one page is ended. The presence/absence of the next original is determined in step S3-8 by checking if an EOP signal of post-message command signals in the CCITT recom-

mendation T.30 is received. If the EOP signal is received, it is determined that the next original is absent.

If it is determined in step S3-2 that there is no available record, and the image memory 30 overflows, and if it is determined in step S3-5 that the number 54 of transfer sub-blocks exceeds the number 53 of storable sub-blocks, the stored image data 31 is deleted on the basis of the file management data 45 and the record chain 46 (S3-10). Thereafter, the corresponding file management data 45 and the record chain 46 are released (S3-11), and the number 54 of transfer sub-blocks is cleared, thus terminating the processing with an error. In, e.g., a substitution reception mode, a communication is immediately terminated with an error.

FIG. 4 is a flow chart showing transfer processing of image data for one file from the image memory 30 to the FD 20 in this embodiment.

The leading sub-block of the leading record of a file to be transferred is set in the transfer pointer 51 (S4-1). If the sub-block indicated by the transfer pointer 51 is transferable (S4-2), the image data 31 is transferred from the image memory 30 to the FD 20 in units of blocks (S4-3). It is determined in step S4-2 that the sub-block is transferable when the image data address pointer 52 is dummy data indicating that the storage operation is not performed, or when no image data address pointer 52 is present in the sub-block indicated by the transfer pointer 51.

After the sub-block is transferred, it is checked if the image data 31 to be transferred is ended (S4-4). This checking operation is attained by discriminating if the end record and the end sub-block, which are indicated by the file management data 45 and the record chain 46 and store the image data 31, coincide with the currently transferred sub-block. If NO in step S4-4, it is checked if all the data for one record are transferred (S4-5). This checking operation is attained by discriminating if the currently transferred sub-block is the end sub-block in the record. If YES in step S4-5, the record chain 46 is referred to renew a record to the next record (S4-6), and the flow returns to step S4-1. In step S4-1, the leading sub-block of the renewed record is set in the transfer pointer 51. If data remains in the record, the flow returns to step S4-1 to renew the transfer pointer 51.

If it is determined in step S4-4 that the image data 31 to be transferred is not ended, an effective flag on the FD, the volume label of the FD 20, a file name, and the like in the file management data 45 are set, and the control waits until the image management data 41 is determined (S4-7). If the image management data 41 is determined, the file management data 22 in the FD 20 is renewed on the basis of the file management data 45 (S4-8), and the transfer processing of the image data 31 is ended.

Note that the storage processing shown in FIG. 3 and the transfer processing shown in FIG. 4 are different tasks, and these tasks can operate independently or simultaneously.

In this manner, the image data 31 and the image management data 41 are held without being deleted after they are transferred to the FD 20. When an image is output in, e.g., a substitution reception image print-out mode, the image data 31 is output based on the file management data 45 and the record chain 46. For this reason, high-speed processing can be performed as compared to a case wherein the FD image data 21 is output.

In this embodiment, processing for deleting image data in the image memory 30 and the FD 20 in, e.g., a substitution reception image output mode will be described below.

The file name of a file to be deleted in the FD 20, which file name is stored in the file management data 45, is stored in the control data storage memory 50. The image data 31 is deleted on the basis of the image management data 41, and thereafter, the image management data 41 is released. The FD file management data 22 is renewed on the basis of the file management data 45, and the FD image data 21 is deleted on the basis of the file name stored previously. Finally, the number of sub-blocks of the deleted FD image data 21 is added to the number 53 of storable sub-blocks, thus ending the delete processing.

FIG. 5 is a flow chart showing processing when the FD 20 is detached in this embodiment.

When it is determined based on the FD detect signal from the FD detector sensor 10s that the FD 20 is detached, the leading file management data is read from the file management data 45 (S5-1). It is then checked if the image data 31 of the corresponding file management data (to be referred to as corresponding file data hereinafter) has been transferred to the detached FD 20 (S5-2). It is determined that the image data has been transferred to the detached FD 20 when the effective flag on the FD of the corresponding file data is set, and the FD volume label stored in the corresponding file data coincides with the volume label 55 of the mounted FD. Only when it is determined that the image data has been transferred to the detached FD 20, the stored image data 31 is deleted on the basis of the corresponding file data and the record chain 46. Thereafter, the corresponding record chain 46 is released, and the file effective flag on the image memory 30 in the corresponding file data is cleared (S5-3). It is checked if the file management data 45 includes the next file management data (S5-4). If YES in step S5-4, the next file management data is read (S5-5), and the flow returns to step S5-2. However, if NO in step S5-4, the number 53 of storable sub-blocks is cleared to zero (S5-6), and the detachment processing is ended.

FIG. 6 is a flow chart showing processing when the FD 20 is inserted in this embodiment. Assume that the inserted FD 20 is formatted in a data read/write enable state.

When it is determined based on the FD detect signal from the FD detector sensor 10s that the FD 20 is inserted, a non-transfer flag in the control data storage memory 50 is set, and the volume label of the inserted FD 20 is stored in the volume label 55 of the mounted FD (S6-1). The presence/absence of the FD file management data 22 is checked (S6-2). If NO in step S6-2, the flow advances to step S6-11; otherwise, the leading FD file management data is read from the FD file management data 22 (S6-3). It is then checked if the FD image data 21 of the FD file management data (to be referred to as corresponding FD file data hereinafter) is present in the inserted FD 20 (S6-4). It is determined that the FD image data is present in the inserted FD 20 when the effective flag on the FD in the corresponding FD file data is set, and the FD volume label stored in the corresponding FD file data coincides with the volume label 55 of the mounted FD. If NO in step S6-4, the flow advances to step S6-9.

If YES in step S6-4, it is checked if file management data coinciding with the corresponding FD file data 21 is present in the file management data 45 (S6-5). If YES in step S6-5, whether or not image data has already been

transferred is discriminated by checking if the file effective flag on the image memory **30** in the file management data is set (S6-6). If NO in step S6-6, the flow advances to step S6-8; otherwise, the flow advances to step S6-10. If it is determined in step S6-5 that no coinciding file management data is present, the file management data **45** is referred to discriminate the presence/absence of available file management data (S6-7). If YES in step S6-7, the flow advances to step S6-8; otherwise, the processing is terminated with a transfer error.

In step S6-8, data transfer from the FD **20** to the image memory **30** is performed as follows. The FD image data **21** is sequentially read out on the basis of FD file management data **22** and the FAT data, is transferred in units of sub-blocks, and is stored in the image memory **30**. The data storage operation in the image memory **30** is performed in the same manner as in steps S3-2 to S3-9 in FIG. **3**. In this case, the number **54** of transfer sub-blocks is not renewed, and the checking operation in step S3-5 is not performed. In step S3-9, the effective flag on the FD is set as well as the file effective flag on the image memory **30** in the file management data **45**. If it is determined that there is no available record in step S3-2, and the image memory **30** overflows, a transfer error is determined in step S6-9, and image data of the file is deleted (S6-13), thus terminating the processing with the transfer error.

If no transfer error is detected (S6-9), it is checked if the FD file management data **22** includes the next FD file management data (S6-10). If YES in step S6-10, the next FD file management data is read (S6-12), and the flow returns to step S6-4. However, if NO in step S6-10, the number **53** of storable sub-blocks is calculated by the FAT, and the calculated number is set (S6-11). Then, the non-transfer flag is cleared, and the insertion processing is ended.

If it is determined in step S6-7 that there is no available file management data, and if it is determined in step S6-9 that the transfer error occurs, the processing is terminated with the transfer error while the non-transfer flag remains set. While the non-transfer flag is set, if available file management data or an available record is found after any processing, the processing in step S6-4 and subsequent steps is performed for the non-transferred file.

In the above-mentioned embodiment, an image stored in the FD **20** is a substitution reception image, but may be a memory transmission image. In this case, the end of an original for one page is discriminated in step S3-7 in FIG. **3** using, e.g., an original trailing end detection sensor, i.e., by checking if whether or not one original page is read. The presence/absence of the next original is discriminated in step S3-8 using, e.g., an original leading end detection sensor. When the processing is terminated with an error, a message indicating that data cannot be stored is alarmed to an operator through the display **6**.

In the above-mentioned embodiment, when the FD **20** is detached, all the image data transferred to the FD **20** are deleted. Alternatively, some image data such as only transmission images or reception images may be deleted. In this case, the step of checking whether or not image data is deleted is inserted between steps S5-2 and S5-3 in FIG. **5**. If the image data is deleted, the flow may advance to step S5-3; otherwise, the flow may advance to step S5-4.

Only the image data **31** transferred to the FD **20** is deleted when the FD **20** is detached. In this case, the corresponding file management data may be deleted at the same time, and may be reconstructed when the FD is inserted.

The present invention is not limited to the above-mentioned embodiment, and various modifications may be made.

What is claimed is:

1. An image communication apparatus, which stores image data in a first memory, and transfers the image data from the first memory to a detachable external storage medium, comprising:

detection means for detecting an insertion/detachment state of said external storage medium;

transfer means for transferring image data in said external storage medium to said first memory upon insertion of said external storage medium; and

delete means for deleting the same image data stored in said first memory as the image data transferred from the first memory to said external storage medium upon detachment of said external storage medium.

2. An apparatus according to claim **1**, further comprising a second memory for storing management data for managing the image data in said first memory, and wherein the image data is deleted according to the management data stored in said second memory.

3. An apparatus according to claim **1**, wherein received image data is stored in said first memory, and thereafter, the image data is transferred from said first memory to said external storage medium.

4. An apparatus according to claim **1**, further comprising:

instruction means for issuing an instruction for deleting arbitrary image data in said external storage medium; and

means for deleting the image data in said first memory and the image data in said external storage medium according to the instruction from said instruction means.

5. An apparatus according to claim **1**, wherein said transfer means transfers some of image data stored in said external storage medium.

6. An apparatus according to claim **1**, wherein said delete means deletes some of image data stored in said external storage medium.

7. An image communication apparatus comprising:

means for generating image data;

first memory means for storing the image data;

a detachable external storage medium;

transfer means for transferring the image data in said first memory means to said external storage medium, and transferring image data in said external storage medium to said first memory means;

detection means for detecting an insertion/detachment state of said external storage medium; and

delete means for deleting the image data in said first memory means,

wherein said transfer means transfers the image data in said external storage medium to said first memory means upon insertion of said external storage medium, and

said delete means deletes the same image data in said first memory means as the image data transferred from the first memory to said external storage medium, upon detachment of said external storage medium.

8. An apparatus according to claim **7**, wherein said transfer means discriminates the presence/absence of

image data in said external storage medium upon insertion of said external storage medium, and transfers the image data in said external storage medium to said first memory means according to the discrimination result.

9. An apparatus according to claim 7, further comprising a second memory for storing management data for managing the image data in said first memory, and wherein the image data is deleted according to the management data stored in said second memory.

10. An apparatus according to claim 7, further comprising:

instruction means for issuing an instruction for deleting arbitrary image data in said external storage medium; and

means for deleting the image data in said first memory and the image data in said external storage medium according to the instruction from said instruction means.

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